EPA Region 5 Records Ctr.
279213

Public Health Assessment for

DEPUE/NEW JERSEY ZINC/MOBIL CHEMICAL CORPORATION
DEPUE, BUREAU COUNTY, ILLINOIS
CERCLIS NO. ILD062340641
DECEMBER 17, 1999

PUBLIC HEALTH ASSESSMENT

DEPUE/NEW JERSEY ZINC/MOBIL CHEMICAL CORPORATION

DEPUE, BUREAU COUNTY, ILLINOIS

CERCLIS NO. ILD062340641

Prepared by:

Illinois Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances & Disease Registry..... Jeffrey P. Koplan, M.D., M.P.H., Administrator
Henry Falk, M.D., M.P.H. Assistant Administrator

Division of Health Assessment and Consultation..... Robert C. Williams, P.E., DEE, Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch ..... Germano E. Pereira, M.P.A., Chief

Exposure Investigations and Consultation Branch..... John E. Abraham, Ph.D, Chief

Federal Facilities Assessment Branch..... Sandra G. Isaacs, Chief

Program Evaluation, Records, and Information ..... Max M. Howie, Jr., M.S., Chief

Superfund Site Assessment Branch..... Acting Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

TABLE OF CONTENTS

LIST OF ACRONYMS

The following acronyms are used in this health assessment:

ATSDR = Agency for Toxic Substances and Disease Registry

CEMEG = Chronic EMEG, for exposures longer than one year

CREG = Cancer Risk Evaluation Guide

EMEG = Environmental Media Evaluation Guide

IDPH = Illinois Department of Public Health

IDNR = Illinois Department of Natural Resources

IEMEG = Intermediate EMEG, for exposures less than one year

ISGS = Illinois State Geological Survey

LTHA = Lifetime Health Advisory, for drinking water

LUST = Leaking Underground Storage Tank

MCL = Maximum Contaminant Level, for drinking water

mg/kg/day = milligrams of chemical per kilogram of body weight per day

MRL = Minimum Risk Level

MS = multiple sclerosis

OSHA = Occupational Safety and Health Administration

ppb = parts per billion

ppm = parts per million

RfD = Reference Dose

RI = remedial investigation

RMEG = Reference Dose Media Evaluation Guide

μg/dL = micrograms per deciliter

USEPA = United States Environmental Protection Agency

USFDA = United States Food and Drug Administration

SUMMARY

The DePue/New Jersey Zinc/Mobil Chemical Site is in DePue, Bureau County, Illinois. Zinc smelting, production of zinc compounds, and production of inorganic chemical products took place at the facility. The past and present owners of the site, collectively known as the DePue Group, have ceased all production and have completed several clean up tasks, which were included in a 1995 Interim Consent Order. Additional cleanup activities are in progress and are being monitored by the Illinois Environmental Protection Agency (Illinois EPA). The site is under consideration for inclusion in the federal Superfund program and was included on the proposed National Priorities List in 1997.

Exposure of workers and residents to air emissions on and off the site probably took place in the years before environmental regulation. Inorganic and metal by-products, generated from various production efforts, migrated onto nearby public and private properties, Lake DePue, and conservation areas. The main site operations were located in the center of town, and homes were built around it.

In 1992, Illinois EPA collected and analyzed soil samples and presented this information to the U.S. Environmental Protection Agency (USEPA) for consideration as a federal site (Illinois EPA, 1992). The data were also presented to the Illinois Department of Public Health (IDPH), which consulted with the Agency for Toxic Substances and Disease Registry (ATSDR). The contaminants of interest are metals. IDPH and ATSDR developed a health consultation which recommended that:

(1) public access to on-site areas be restricted,
(2) procedures to suppress dust generation and migration during on-site removal/remedial operations, including demolition activities, be implemented,
(3) additional studies to better characterize the extent and degree of off-site soil contamination in residential yards and where areas of significant contamination are identified to consider strategies for reducing exposures to contaminated soils be considered, and
(4) community health education initiatives, informing residents on methods to reduce their exposure to contaminated soils and dust be continued (ATSDR, 1992).

Most of those recommendations either have been implemented or are under consideration and were included in the 1995 consent order.

In response to questions from Illinois EPA about the need for an emergency cleanup action, IDPH conducted biological screening of volunteers in September 1993 to collect blood and urine samples, which were analyzed for cadmium and lead. Three individuals, one in each of the three types of samples collected, had an elevated concentration. Further investigation of those three individuals revealed lead and cadmium sources in their homes or workplaces. No immediate public health hazard was demonstrated by the blood and urine screening, and a recommendation for emergency cleanup action did not appear to be necessary.

Through the 1990s, a number of actions have been taken by the site owners. The growth of groundcover on the site properties has been markedly improved, and a dust suppression program has been implemented. Air sampling was conducted until sufficient data were available to demonstrate that air standards for metals were not exceeded. An interim water treatment facility was built and became operational in 1997. A program to divert clean surface water around the site is being implemented. Work on the South Ditch leading into Lake DePue has begun, and the work plan for the site-wide remedial investigation is under consideration. The site has been very dynamic, and a sizeable investment has been made by the DePue Group to reduce exposures and to limit the migration and erosion of wastes.

Although biological sampling in September 1993 did not demonstrate any problematic exposures in the volunteers, workers and residents were likely exposed to contaminants in the past. Several of the site areas have been improved since 1992; however, heavy metal contamination remains. Metals do not break down in nature, so metals that were deposited on surface soils, unless physically disturbed, will be present for many years to come.

IDPH considers the site a public health hazard because of potential exposures to contamination in surface soils and sediments and because of likely long-term, past exposures. IDPH and ATSDR will continue to evaluate the need for any further health follow-up activities when additional information from the remedial investigation and cleanup activities becomes available.

IDPH has conducted educational programs that showed residents how to reduce exposures to site-related metals in soil. Education targeting local health professionals has also been conducted. IDPH will continue to coordinate educational efforts in the future as deemed necessary.

State-owned properties impacted by the site, including conservation areas and Lake DePue, are managed by the Illinois Department of Natural Resources (IDNR). IDNR is conducting independent investigations of the impact of metals on these areas.

BACKGROUND

In cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), the Illinois Department of Public Health (IDPH), evaluated the public health significance of the DePue/New Jersey (NJ) Zinc/Mobil Chemical Site in DePue, Illinois, based on available data. More specifically, IDPH determined whether adverse health effects are possible and recommended further actions to reduce or prevent possible health effects.

The site is a former primary and secondary zinc smelting facility. From early in the century to the 1940s, coal was the principal fuel. Natural gas was used from the 1940s to the 1970s. Acids and fertilizers were produced on the site as well. The past and present owners of the site are collectively known as the DePue Group. The DePue Group entered into an Interim Consent Order in 1995 with the Illinois Environmental Protection Agency (Illinois EPA) and the Illinois Attorney General that required several cleanup activities. The DePue Group and their contractors have:

- increased security and restricted access to the site properties;
- implemented a dust suppression program;
- completed a focused remedial investigation (RI) of the South Ditch leading to Lake DePue;
- submitted a focused feasibility study of the South Ditch for clean up of the South Ditch;
- developed an interim heavy metal water treatment system;
- developed a program to divert clean surface water away from the site;
- completed a cleanup of the former vanadium catalyst disposal area;
- removed materials from the former settling ponds south of Marquette Street; and
- continued the activities associated with the closure of the "gypstack" (short for the phosphogypsum stack) area and the main operations areas.

In recent years, the DePue Group placed air monitoring stations around the site, and samples were collected for 14 months. The results of this sampling effort demonstrated that current emissions were not violating air standards. Plans for the assessment of other contaminated areas are being reviewed by Illinois EPA.

The Illinois Department of Natural Resources (IDNR) is conducting investigations associated with metals found on state property and nearby conservation areas. Lake DePue was dredged in the 1980s to increase the depth of the water body, and the metal-containing sediments were placed in conservation areas.

The site was listed on the proposed National Priorities List in March 1997.

A. Site Description and History

The site is south of Illinois Route 29 in southeastern Bureau County, Illinois (Figure 1). About 10 miles northwest of the site is Princeton, the county seat, with a population of about 7,200 people (Figure 2). Spring Valley, population 5,200, is the closest commercial/industrial community and is about 6 miles upstream on the Illinois River. A non-industrialized community, Tiskilwa, has a population of about 1,000 people and is 10 miles southwest of DePue. Tiskilwa was selected by Illinois EPA as a comparable community for some background environmental sampling (Illinois EPA, 1992). Bureau County is largely zoned for agricultural use. The original development of DePue began on farmland at the turn of the century. This area was chosen for development in response to the market demand for zinc and because of the abundance of local coal and railroad access. Figures 3 and 4 show the proximity of DePue and community landmarks to the site areas.

The following sections describe several distinct areas of the site.

The Main Zinc Operations Area

Former zinc smelting operations occurred in the center of the village of DePue. Primary zinc smelting began early in the century and used coal as fuel until the 1940s. Natural gas was used as fuel for smelting from the early 1940s until the 1970s. Sulfuric acid was made until 1948 by using sulfuric dioxide gas produced during the coal-fired roasting process and vanadium pentoxide as a catalyst. Zinc ore from Elmo, Wisconsin, and Gilman, Colorado, was processed at a rate of 71,000 tons annually in 1967 (Illinois State Geologic Survey, 1986). The smelting and coal cinder wastes, called "the gob pile" or the "cinder bank," is found near the former smelting operations. The gob pile covers about 15 acres along Marquette Street (Figure 4) and contains solid smelting wastes and coal cinders. A sample from the gob pile collected during a 1975 inspection contained elevated concentrations of metals (Illinois EPA, 1975). Gibb and Cartwright (1982) determined that a 1-foot to a 5-foot layer of cinders covers about 90 acres of the site. Ridges formerly located north of the gob pile contained some zinc and barium wastes and were known as the "lithopone ridges." In 1989, the gob pile and two lithopone ridges were covered with 18 inches of soil and were seeded.

Eleven piles of solid waste were measured during a site inspection in 1993 (Illinois EPA,1993a). Black fines, briquettes, bricks, concrete, construction debris, pieces of barrels and iron, rock, cinders, ditch dredge, lime, railroad ties, white crystals, and wood pieces were described in the inspection report (Illinois EPA, 1993a).

Only a few of the original site buildings remain. One building was converted to a facility to house the mechanical and monitoring systems for the water treatment plant, which collects surface water and shallow groundwater, removes metals, and returns the treated water to the South Ditch. Fencing surrounds the main operations area.

Fertilizer Area

North and west of the old smelting area is where inorganic fertilizer processing occurred. In 1966, the area was developed to process phosphate ores and other inorganic chemicals for acid and fertilizer productions. This fertilizer area shares a fence line with East Street. An acid plant was built to serve the fertilizer operation where phosphate ore was converted to phosphoric acid using sulfuric acid. This plant used Illinois River water for cooling and discharged non-contact cooling water through two cooling ponds on the north bank of Lake DePue. In 1980, a sulfuric acid spill on the site led to the partial evacuation of the village because of reported hydrogen sulfide gas in the air (Illinois EPA, 1983). One death and two injuries were attributed to this accident. Shortly thereafter, the company modified the sewer systems to isolate the fertilizer plant drainage from the village of DePue's system.

Underground tanks storing diesel fuel and gasoline formerly existed in this area. An incident report was filed with the Illinois EPA Leaking Underground Storage Tank (LUST) program in 1990 when, during removal and closure of three underground storage tanks, petroleum-related soil quality impacts were discovered. Exploratory digging, drilling, and monitoring well installations were conducted to determine the extent of the contamination. The Illinois EPA LUST program directed the cleanup activities.

In 1992, a radiation detector alarm was triggered at a scrap metal facility that was receiving site materials. The Illinois Department of Nuclear Safety conducted a radium survey of the site in April 1992. Radium was present at the site, but the radiation levels measured did not present a health risk to the on-site workers (IDNS, 1992). Radium is a naturally-occurring element in phosphate rock.

Areas South of the Main Operations

Marquette Street connects downtown DePue to the subdivision on the bluff to the northeast known as "White City." Pedestrians and bicyclists frequently use the sidewalk bordering the site along Marquette Street. In the past, green-tinted water pooled near the sidewalk. The DePue Group has installed a groundwater collection system and has raised the sidewalk in recent years to alleviate the standing water.

The South Ditch, which is south of Marquette Street, south of the former main operations area, and north of Lake DePue, has been the objective of a focused remedial investigation (RI). Cyclone fencing has been installed around the South Ditch, and sampling and cleanup actions are progressing. A recent ecotoxicological investigation of the sediments collected from the South Ditch resulted in the mortality of midge larvae and amphipods in the laboratory (Golder, 1997).

The Gypstack Area

The gypstack (short for phosphogypsum stack) is north of DePue on Illinois Route 29 (Figure 4) and is the largest site area. Gypsum was the main byproduct of the fertilizer manufacturing process and was pumped overland to this area. A clay barrier is under a portion of the gypstack, but information about the extent or thickness of the clay barrier is limited. During the 1970s, some local farming interests accepted gypsum, presumably to be used as fertilizer. The gypstack was designed with a water collection system that was part of a closed-loop management system. Today, grading has leveled the stacks, improvements have been made to manage precipitation and surface water, a vegetative cover has been established, and security has been improved with the installation of fencing and gates.

Lake DePue

Lake DePue is an "oxbow" lake and part of the backwater of the Illinois River (Figure 3). The lake and nearby creeks are part of Illinois' largest watershed, the Illinois River basin. Lake DePue is about 525 acres in surface area, has about 11.3 miles of shoreline, and has a maximum depth of 1.8 meters (Illinois EPA, 1978). Soil erosion contributes to the sedimentation and filling-in of backwater lakes. A narrow channel connects the lake to the Illinois River at river mile 221.

Lake DePue was dredged by the state in 1972, and again from approximately 1979 through 1982. Sediments were removed from the bottom to deepen the part of the lake used for an annual boat racing event. The dredged material from the lake bottom was placed on land between Lake DePue and the Illinois River. According to a 1983 preliminary assessment developed for USEPA Region V, approximately 188,000 dead fish were reportedly observed in Lake DePue in August 1974 (USEPA, 1984).

The water and sediment quality of Illinois lakes and creeks have been monitored, sampled, and evaluated by Illinois EPA since the 1970s. The Illinois Water Quality Reports developed by the Illinois EPA rate the uses of surface water bodies throughout Illinois. In 1992, Illinois EPA determined that Lake DePue had been impacted by metals, siltation, and suspended solids, caused mainly by industry and agriculture (Illinois EPA, 1994).

The Illinois Water Quality Report published in September 1996 determined that elevated levels of zinc in river and stream sediments impacted more waterway miles in Illinois than any other parameter monitored (Illinois EPA, 1996). Lake DePue is also part of the Illinois Fish Contaminant Monitoring Program, for which fillets of lake fish are sampled every odd-numbered year (Illinois EPA, 1994).

In October 1992, the Illinois Department of Conservation (now part of IDNR), IDPH, and the U.S. Food and Drug Administration (USFDA) collected five fish species from Lake DePue. A

USFDA laboratory filleted and analyzed the five fish species for some metals (USFDA, 1993). Zinc was the most concentrated metal analyzed in the fish flesh (Table 9).

Residential Areas

Another area under consideration is off-site residential, public, and private properties (Figures 3 and 4). Rail lines, roadways, and other building projects may have used smelting waste for fill material because of its strong load-bearing properties. Off-site properties contain metals in yards, gardens, and play areas (Tables 3 and 4).

Public Health Involvement

During an Expanded Site Inspection in March 1992, Illinois EPA collected 37 soil and sediment samples from areas on and off the site (including two background soil samples from the city of Tiskilwa and one background sediment sample from Lake Turner). During the sampling event, five surface water samples (including one background sample) were collected (Illinois EPA, 1992). The results (included in Tables 1 through 7) were forwarded to IDPH, which shared the information with ATSDR. A health consultation dated July 28, 1992, concluded that conditions warranted additional sampling activities (ATSDR, 1992).

To further characterize residential neighborhoods, IDPH collected 65 composite surface soil samples in December 1992 from the top inch of surface soil. Samples were collected from "metal-neutral" areas that were not located near any roads, drives, buildings, drip lines, burn barrels, fences, or similar structures. Targeted samples were collected from areas around the perimeter residential neighborhoods, which surround the main operations area. In addition, random samples were collected from the southern, eastern, and western residential areas. These surface soil samples were analyzed for cadmium, lead, and zinc (Table 4).

During 1993 and 1994, IDPH staff collected indoor residential dust samples from 15 homes in DePue. Those samples were analyzed for cadmium, lead, and zinc (Table 11). House dust is an environmental medium that is readily available to residents, especially younger children. If good housekeeping and personal hygiene practices are not followed, metals can accumulate in house dust from several environmental and consumer sources.

Illinois EPA collected additional environmental samples in April 1993, which included water and sediment samples from east and west of the Marquette Street storm sewer grate, from the north end of the South Ditch, and from two samples from an on-site surface water ditch that runs along the south edge of the lithopone stacks (Illinois EPA, 1993b). USEPA also sent contractors to the area for additional environmental samples in the spring of 1993 (Ecology and Environment, 1993). The results of those sampling events are included in the appropriate areas of Tables 1 through 7.

In September 1993, IDPH, with the assistance of the Bureau County Health Department, Illinois EPA, and contractual nursing staff, conducted lead and cadmium screening of volunteers from the community to learn if an immediate public health hazard existed. A temporary clinic was established at the DePue Veterans of Foreign Wars (VFW) building for three days. Blood and urine samples were collected and analyzed for cadmium and lead (Tables 12 through 14). In total, 110 individuals volunteered for the screening. One child had an elevated blood lead level. One senior citizen had an elevated urine cadmium level, and one other adult had an elevated blood cadmium level. Workplace and residential metal sources were identified for those three individuals.

Former DePue residents have given IDPH and Illinois EPA information about nine persons who have been diagnosed with multiple sclerosis (MS) (IDPH, 1996). With funding and technical assistance from ATSDR, IDPH contracted with staff at the University of Rochester who specialize in MS and biostatistics. The nine MS cases have been confirmed. A report that summarizes this investigation is included as Attachment 1. These findings were presented in a workshop at the Bureau County Health Department, which IDPH and the National MS Society cosponsored in September 1998. Dr. Randolph Schiffer reported that although zinc exposure has been theorized as an environmental cause of MS, there is no clinical evidence to substantiate this claim.

IDPH and Illinois EPA have provided educational activities and materials for the community and health care professionals. In 1992 and 1997, IDPH provided workshops for the medical staff at St. Margaret's Hospital in Spring Valley and for St. Mary's Hospital in Princeton that discussed the clinical implications of metal exposures. A workshop on MS was presented in 1998. Educational efforts, public meetings, and information have been provided to community members on methods to reduce exposures to metal residues, including discussions about nutrition, dust control methods, thorough house cleaning, and gardening issues. The information, written in Spanish as well as English, and interpreters have been provided for the Spanish-speaking participants at public functions.

Illinois EPA regularly organizes public meetings with the DePue Superfund Citizens' Advisory Committee. The Bureau County Health Department is involved with continuing educational efforts concerning ways families can reduce common heavy metal exposures.

IDPH acknowledges the assistance of residents, community leaders, and local officials, including the village of DePue president, the village of DePue city clerk, the Superintendent of Schools, County Board Members, and Bureau County Health Department personnel during the development of this document. The organizations that have provided information and assistance include USEPA, Illinois EPA, IDNR, the Bureau County Health Department, and USFDA. Managers and consultants for the DePue Group have provided site tours and information.

B. Site Visits

IDPH staff made the first site visit in the spring of 1992 shortly after the receipt of the Illinois EPA sampling results from earlier that year. During the first week of December 1992, IDPH staff collected surface soil samples from residential areas and conducted a door-to-door survey. Several visits were made to sample house dust and to prepare for biological screening held at the VFW hall in September 1993.

IDPH staff most recently visited the area on September 29, 1998. On September 24, 1997, IDPH staff attended a tour, which was conducted by the DePue Group, of the interim water treatment plant, the gypsum stack, the South Ditch, the managed wetlands, and other site areas. On several occasions, IDPH staff has been invited to present to the DePue Citizens' Advisory Committee, which meets every month to follow the progress made on the site. IDPH staff has also been invited to speak during Illinois EPA-sponsored functions and public meetings in the community.

C. Demographics and Natural Resource Use

Demographics

According to the 1990 census, about 2,430 people live within 3 miles of the site, and 1,729 people live within 1 mile of the site in the village of DePue. Approximately 565 individuals in the village are of Hispanic descent. The closest residential properties include approximately 20 homes that share the site's western fence line along East Street. The older section of the village is south of the site.

DePue experienced a population shift when site operations began to downsize in the 1980s. At one time, as many as 3,000 workers were reportedly employed at the site. Today, the on-site workers include four water treatment plant operators and a site manager. In addition, contractors hired for short-term tasks associated with cleanup activities frequently visit the site. Contractors hired for regulatory compliance activities visit on occasion, but their home offices are in other communities.

In 1990, the median year of construction of DePue homes was 1939 and the median value of housing units was $24,900. The median DePue household income in 1989 was $21,250, and 100 households had incomes at or below the poverty level. On May 18, 1993, Illinois EPA staff counted 446 occupied homes within the area of potential contamination (Illinois EPA, 1993a).

A school is south of the site in the old section of DePue. In 1992, approximately 400 students, representing about 250 families, in grades K through 12 were enrolled. Some families transport their children to private schools in neighboring communities. A day care facility operated by a church is across the street from the school. A nursing home is on a bluff to the north, overlooking the river valley.

Natural Resource Use

Bureau County is largely rural and zoned for agricultural use. About 94 percent of the county is farmland, with approximately 2,000 farms.

Drinking water in DePue is obtained from an aquifer almost 1,500 feet deep that serves nearly the entire village. According to the most recent census information, nine households in the area have private wells that are upgradient of the former plant site.

Surface water runoff from the site to Lake DePue occurs especially following rain or snow. Annual precipitation is roughly 36 inches. The 100-year flood plain along the Illinois River includes most homes that border Lake DePue. The South Ditch is also within the 100-year flood plain.

Lake DePue is used for swimming, fishing, boating, jet-skiing, and boat races. The lake is easily accessible from the public park and boat ramp on the northern bank. Tourist attendance at annual boat races and other recreational uses of the lake has been estimated at 60,000. The village has been the host to boat races 23 times since 1961 (Village of DePue, 1996). The State has dredged the lake in the past to deepen the waterway for the races. The lake appeared to be well stocked during the fish sampling in October 1992.

Several municipal storm sewer pipes and the village of DePue's water treatment plant also discharges to the lake. The community of DePue has hopes of developing a better-known recreational area to attract additional tourists to their village to boost the local economy.

Waterfowl frequent the local habitat. Several locally-managed conservation areas are adjacent to the Illinois River near DePue. Between the lake and the river is an area managed by IDNR to attract ducks during hunting seasons. Some parts of these wetlands are suspected to have been the place where sediments removed from Lake DePue were deposited after dredging by the State (Illinois EPA, 1997a). In 1993, IDPH staff observed hunters carrying game.

D. Health Outcome Data

One resident living near the site reportedly died of exposure to hydrogen sulfide following an accident at the facility in 1980. The accident occurred when a sulfuric acid spill resulted in an apparent hydrogen sulfide gas release during fertilizer manufacturing. Residents were evacuated from the area. The village's sewer system was later modified to prevent a similar occurrence.

During some public meetings, a few residents asked about cancer prevalence rates. Statewide reporting is required for several cancer types and data are collected by the IDPH Division of Epidemiological Studies. In February 1994, the incidence of cancer in DePue was analyzed for cancer cases reported to IDPH from 1987 to 1991. Forty cases of cancer were observed within

the DePue zip code area (61322) with 45 cases expected. This difference was not statistically significant (IDPH, 1994).

In September 1993, IDPH organized blood and urine screening for lead and cadmium. IDPH invited the community to participate through notices in utility company mailings, meetings, and with the assistance of community leaders and other private and public organizations. Blood and urine samples from 110 volunteers were analyzed for cadmium and lead (Tables 12 through 14). One child had an elevated blood lead level. One senior citizen had an elevated urine cadmium level and one adult had an elevated blood cadmium result. Further investigation revealed potential workplace or household lead and cadmium exposure sources for the three individuals.

Some community members reported to Illinois EPA and IDPH information regarding nine people who have resided in DePue and have been diagnosed with MS. IDPH consulted with ATSDR regarding these concerns (IDPH, 1996). Medical records of these cases were collected after consent was received. A neurologist specializing in MS reviewed and confirmed the records. The statistical evaluation of these data was presented in a report provided to IDPH (Attachment 1). This investigation statistically identified an elevated incidence rate from the period of 1971-1990. It did not attempt to identify any mechanisms underlying the development. The specific factors leading to MS remain unclear to medical researchers everywhere and was not an issue this investigation could answer.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

This section summarizes the data reviewed and evaluated for this report and includes discussions of the contaminants of interest and the public health significance of this site. The tabulated data is included at the end of the public health assessment. IDPH selects and discusses contaminants of interest based upon the following factors:

1. Concentrations of contaminants on and off the site;
2. Field data quality, laboratory data quality, and sampling design;
3. Comparison of on-site and off-site concentrations with health assessment comparison values for noncarcinogenic and carcinogenic endpoints; and
4. Community health concerns.

The discussion of a substance as a contaminant of interest does not mean that it will cause adverse health effects from exposures. Instead, the list shows the contaminants that will be evaluated further in the public health assessment. When selected as a contaminant of interest in one medium, that contaminant will be evaluated in all media.

Comparison values used to select contaminants of interest are contaminant concentrations in specific environmental media. These values include Environmental Media Evaluation Guides

(EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant guidelines. EMEGs are comparison values derived to protect against noncancerous health effects, and CREGs are based on a probability of one excess cancer in a million persons exposed to a chemical over a lifetime, calculated from USEPA cancer slope factors. Maximum Contaminant Levels (MCLs) represent regulatory contaminant concentrations for public drinking water that USEPA deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of drinking two liters of water each day. USEPA develops RfDs (Reference Doses) and ATSDR develops MRLs, which are estimates of daily exposures to contaminants below which are not expected to cause adverse health effects.

IDPH conducted a search of the USEPA Toxic Chemical Release Inventory (TRI) database for local zip codes (Table 10). The only reports filed from five local zip codes were those from industry in Spring Valley, approximately 6 miles upstream from DePue.

Much of the environmental sampling data reviewed was collected in the early 1990s, before activities that occurred after the consent order was finalized. We expect that more data will be available for review in the future as the RI and clean up efforts continue.

A. On-site Contamination

On-site Solid Waste Materials

Substances used or generated at the site included "gypsum" sludge (inorganic waste from fertilizer production), a vanadium pentoxide catalyst, smelting wastes, cinders, sulfur dioxide gas (a feedstock for sulfuric acid production), phosphoric acid, phosphate rock, zinc ores, ammonia, diammonium phosphate, lithopone (a zinc pigment consisting of zinc sulfide, barium sulfate, and zinc oxide), solvents (xylene and toluene), coal, gasoline, and diesel fuels. The chemicals and process feed stocks were stored in railroad tank cars, aboveground tanks, underground tanks, and drums. At one time, the quantity of waste at the smelting facility was estimated to exceed one million cubic yards (Illinois EPA, 1982).

Smelting wastes were placed on the ground at the site for many years. Illinois EPA sampled the gob pile north of Marquette Street in March 1992 (Table 1, samples X112 and X113). USEPA and their contractors sampled the same area in March 1993 (Table 1, sample ZN10). Wastes from the lithopone operations placed in ridges north of the gob pile were also sampled by both agencies (Table 1, samples X114, X115, and LP20). A 30 by 50 foot area contained about 25 drums of spent vanadium catalyst, which consisted primarily of quartz rock and a small amount of vanadium pentoxide. A composite sample of the drummed catalyst waste was collected in March 1993 by USEPA (Table 1, DC10). This area and the drummed waste were cleaned up in March 1994.

Waste from the smelting operations was also found south of Marquette Street near the South Ditch. This fill (Table 1, sample X116) appears to be similar to the types and levels of contamination as the on-site gob pile and lithopone ridges. A composite of six samples from this area was collected in 1993 by USEPA (Table 1, sample SM40). This area was also used as a municipal dump many years ago. Residents reported that children easily accessed that area in the past and frequently played there. A cyclone fence has been installed around the South Ditch area.

Samples were collected from the gypstack area north of DePue by Illinois EPA in March 1992 (Table 1, X107) and by USEPA in March 1993 (Table 1, GY30). Calcium, a component of gypsum, was found at elevated levels in the solid waste. Calcium has no health comparison values and is not usually a toxic substance, so we will not evaluate it as a contaminant of interest. Sulfate, another component of gypsum, was elevated in the water sample collected from the area (Table 7, S305). Ammonia was also elevated in sample S305. The character of the gypsum waste pile is very different from the waste on the main smelting operations area where metal concentrations are elevated. The solid gypstack sample (X107) was also analyzed for organic compounds; however, the only detected compound was bis(2-ethylhexyl)phthalate, estimated at 120 parts per billion (ppb).

The gob pile and lithopone pigment waste contain some of the highest concentrations of the metals tested. The metals found in the on-site solid wastes at concentrations higher than the Tiskilwa background samples included arsenic, barium, beryllium, cadmium, cobalt, copper, chromium, iron, lead, manganese, selenium, silver, sodium, and zinc. Cyanide was also found in the gob pile. Many activities have occurred on the site properties since the 1992 and 1993 sampling events. Remediation efforts should prevent further erosion, migration, and worker exposure. Data generated from these older sampling events is useful when considering past exposure.

On-site Soil

During a research project conducted by the Illinois State Geologic Survey (ISGS) and Water Survey in 1976, four borings up to 18 feet in depth were removed from the former plant area and analyzed for cadmium, copper, lead, and zinc. The most concentrated, on-site soil sample intervals are shown on Table 2, listed as ISGS1, ISGS4, ISGS6, and ISGS7. Monitoring wells were then installed in those four areas.

Three on-site soil samples were collected at different depths from the main operations area in March 1992 and analyzed for metals and cyanide (X109, X110, and X111). The results of these samples are compared in Table 2 with two background soils (from Tiskilwa) collected during the same sampling event. Compared with the background soil samples, most of the metals on the site have higher concentrations than the metals found in Tiskilwa. However, no cyanide was detected, and aluminum, antimony, potassium, and sodium levels are lower than the background sample.

Lead was highly concentrated in on-site soil samples X110 (17,800 ppm) and X111 (33,400 ppm). Lead paint may have been used on buildings, equipment, or other structures, adding to the lead burden on these properties. Cadmium levels in the samples collected from the site ranged from 20.6 to 278 ppm. Arsenic in the on-site soils was also greater than background, ranging from 14.3 to 268 ppm.

The DePue Group collected composite surface soil samples in August 1994 at three proposed vegetative test plot areas on the site (Terra, 1995). The sample results are included on Table 2 as TPA1, TPA2, and TPA3. This effort was part of the owners' investigation about which species would be selected to plant on the site.

Dust and erosion control measures have been implemented, so contaminated surface soils on the site properties appear to be controlled and less likely to be affected by wind and water erosion than at the time of the sampling.

On-site Surface Water

Illinois EPA collected a sample of leachate from the gob pile in June 1975 (Table 7). In 1992, two water samples were collected in the discharge area on the bank of Lake DePue (S304 and S303). Lagoons near the South Ditch were used for settling impoundments and were sampled in 1992 and 1993 (Table 7). Dewatering or evaporative ponds were intentionally engineered at the gypstack. Illinois EPA sampled a large settling pond next to the gypstack's southeast perimeter in March 1992 (S305). Lake Turner was selected as a background water sampling site for the sampling event of 1992.

The collection and treatment of surface water that finds its way onto site properties have been a focus of remediation activities this decade, and potential exposures to contaminants in surface water should not be as problematic today as in past years. Additional data regarding the metal concentrations found in the on-site surface water will be evaluated as they become available.

On-site Sediments

In March 1992, four sediment samples were collected on the site, and one background sediment sample was collected from Lake Turner (Table 5). The sediments had more detections of organic chemicals than any other environmental media (Table 15), but all were at levels less than comparison values. Three ditch sediment samples were collected from the northern end of the South Ditch in May 1994 and analyzed for metals (Table 5) (Terra, 1995).

Additional sediment samples were collected from the uppermost layer (0-6") of the South Ditch in March 1996 (Table 6) (Golder, 1997). Four background surface sediment samples were also collected from Lake Turner during this sampling event. More data will likely be generated as the cleanup of the South Ditch continues.

On-site Groundwater

The ISGS and the Illinois State Water Survey initiated a study of site groundwater in 1976 and 14 monitoring wells were installed in 7 locations around the former plant site. In 1990, four monitoring wells were installed on the site at the west end of the former plant. Ten additional wells were installed in 1992 in the former underground storage tank area.

Four piezometers were installed in the gypstack area in late 1992, and three more were added in the fall of 1993 to monitor groundwater elevations. In 1994, 17 more piezometers were installed at the former plant site. Groundwater was collected from the former plant site area monitoring wells and piezometers from December 12, 1992, through May 6, 1994, (Terra, 1995) and was analyzed for metals (Table 8).

The DePue Group installed 10 monitoring wells around the South Ditch in 1995 (Golder, 1997) to determine groundwater quality for the RI. Three wells south of Marquette Street were sampled on January 29, 1996 (Table 8) (Illinois EPA, 1997).

B. Off-site Contamination

Off-site Wastes

Limited information is available regarding site-related wastes that may have been transported off the site and used on private and public properties. Long-time residents have reported that rail lines built in this community used site waste materials in the rail bed. In the past, as a good neighbor policy, the site operators may have allowed residents to use site wastes for fill, driveways, or other uses.

Off-site Soil

Off-site contamination does not appear to occur in any regular patterns in the residential properties of DePue. In other words, residential soil several blocks away from the site may have less, more, or equal amounts of contamination than residential soil next to the site. All of the off-site soil samples reviewed for the public health assessment were collected from an area less than 0.25 miles from the site. Many residents do not know how their yards have been managed since the early part of the century.

Some public and private properties in DePue have elevated metal concentrations. Illinois EPA collected 20 surface soil samples in March 1992 that were analyzed for several metals (Table 3). Generally, Illinois EPA scraped away the uppermost layer of soil with a stainless steel scoop before collecting the sample. If sod was present, it was removed before the sample collection.

To further characterize the extent of the residential soil contamination, IDPH collected 65 surface soil samples in December 1992 and analyzed them for cadmium, lead, and zinc (Table 4). IDPH collected the top inch of soil from five bores within a square foot area to make up one composite sample. A common confounding factor is that yard fertilizers, especially phosphates, contain trace metals. Amending soils in the area may have been a common practice, since fertilizer was produced locally and was readily available.

Metals generally do not leach into subsurface soils, so levels of metals tend to decrease with depth. Metals can be taken up by garden vegetables dependant upon soil conditions and the type of plants cultivated. No data are available at this time regarding the concentration of metals in the edible portions of garden vegetables grown in DePue. Educational efforts have been made to give residents information on methods that should reduce exposures to metals if present in garden products.

Off-site Surface Water

Water runoff from the site frequently resulted in standing surface water along the sidewalk north of Marquette Street. Sometimes those temporary pools would cover the walkway. A sample of standing water collected by IDPH in December 1992 contained high levels of cadmium, lead, and zinc. After discussing the results with Illinois EPA, the project manager arranged for additional samples to be collected from pools next to Marquette Street in April 1993 (Table 7 samples S102 and 103).

IDNR continues assessment of the wetlands and conservation areas around Lake DePue.

Off-site Sediments

The condition of Lake DePue and Illinois River sediments has been followed since the construction of navigational dams on the Illinois River in 1933. As the river currents slowed, many backwater lakes were created. Cahill and Steele conducted a survey of backwater lake sediments along the entire length of the river (Illinois State Geologic Survey, 1986). Lake DePue was determined to contain more metals and had the greatest sedimentation rate of the lakes measured. Sediment samples were collected in 1975, 1978, and 1982. The highest concentrations of metals found were 5,000 ppm of zinc, 116 ppm of cadmium, 211 ppm of lead, and 130 ppm of copper on the east end of the lake (ISGS, 1986).

As with surface water, the sediments that are part of the wetlands and conservation areas managed by IDNR are currently under investigation.

Off-site Ambient Air

Because of concerns about fugitive dust, a sampling plan was developed to measure metals in ambient air. The DePue Group installed six air monitoring stations in the fall of 1994 around the perimeter of the site properties to determine if metals were being transported off the site in fugitive dust. Twice a week, from September 1994 through December 1995 and during some intervals in 1996, 24-hour samples were collected. Samples collected until June 1995 were tested for 24 metals and total suspended particulates. After 1995, air samples were analyzed for nine metals. In more than 800 samples, only a few metals were occasionally detected (Table 16). USEPA concluded that no hazard exists due to exposure to metals and airborne particles. With the approval of Illinois EPA, the air monitoring program was stopped. Dust control programs, grading, and planting vegetative cover will aid in reducing wind erosion and fugitive dust formation.

Off-site House Dust

IDPH collected indoor dust samples from 15 DePue homes in 1993 and 1994. Dust from carpeting and from smooth surfaces were analyzed for cadmium, lead, and zinc (Table 11). Metal residues deposited on rigid surfaces, such as roads, sidewalks, porches, and parking areas, can be brought indoors by tracking. Some homes in DePue contained metal levels in house dust that exceed typical Illinois soil concentrations (Table 4). At the same time, other homes sampled had very low levels of metals in dust. The median house dust concentrations were 18 ppm of cadmium, 139 ppm of lead, and 150 ppm of zinc, all lower than the median concentrations found in DePue residential surface soils (Table 4).

The ranges of metal dust concentrations were from below the detection level to 128 ppm for cadmium; 27 to 2,760 ppm for lead; and 35 to 4,100 ppm for zinc. This may be attributed to differences in house cleaning. For example, the residents of the home with the carpet sample that contained the highest lead dust loading value (26,188 micrograms per square foot) did not have a vacuum cleaner.

The house dust standard for lead in Illinois homes where children with elevated lead levels reside is 200 micrograms per square foot on smooth surfaces. There are no standards for cadmium or zinc in house dust. Cigarette smoke contributes to the metal concentrations found in indoor dust, especially cadmium. Metals are added to some formulations of latex and rubber products, such as those found in non-skid backings on rugs. Leaded paint is a well-known source of lead found in interior dust.

Biota

Some metals have been shown to accumulate in plants and animals. As discussed under the off-site soil section, area residents may be consuming garden vegetables grown in soils containing

heavy metals. Uptake of metals into plants may be accelerated if acidic conditions and low organic materials are found in residential vegetable gardens. In 1992, a garden was growing near a highly contaminated area (near sample site X108) close to the South Ditch. Some farming interests may have used gypsum as fertilizers. No data are known to exist regarding the concentration of metals in garden vegetables produced in DePue.

A fish kill in Lake DePue in 1974 was attributed to plant activities, and the company paid a fine to Illinois EPA. Illinois EPA and IDPH established a sport fish consumption advisory for this section of the Illinois River in 1986 because of PCB contamination from other areas upstream (Illinois EPA, 1996).

In 1992, USFDA analyzed the levels of arsenic, lead, cadmium, chromium, nickel, and zinc in five Lake DePue fish species (Table 9). The USFDA lab filleted each species and analyzed the fillets as a composite. Zinc was the most concentrated metal detected. No detectable levels of arsenic, cadmium, or lead in edible fish samples were found. Some low levels of chromium, nickel, and zinc were found; however, they were within typical ranges of concentrations published in ATSDR Toxicological Profiles.

In 1996, the DePue Group's contractor (Golder, 1995) collected composites of three 0 to 6 inch surface sediment samples from eight transects of the South Ditch for an ecotoxicological investigation using two benthic invertebrates common in Illinois. The test was conducted for 4 days instead of the usual 10-day period. All of the organisms died in 15 of the samples, and only 15% were alive in one sample after four days.

Waterfowl visit the wetlands in the area, and hunting is permitted periodically. IDNR is currently investigating the status of metal concentrations in the nearby conservation areas.

C. Quality Assurance and Quality Control

In preparing this public health assessment, IDPH relied on the information provided in the referenced documents and assumed that adequate quality assurance and quality control measures were followed regarding chain-of-custody of samples, laboratory procedures, and data reporting. The analyses and conclusions in this public health assessment are valid only if the referenced information is complete and reliable.

D. Physical and Other Hazards

Fire and explosive conditions may have existed when large volumes of fuel, acids, and products were being stored at the site. Presently, no fire or explosive hazards exist. The site has been graded, and a fence with several locked gates restricts access from Marquette Street.

At one time the fencing consisted of different materials, including a wooden privacy fence at the south border. Gaps in the fence existed through the years along the eastern overpass, and trespassers could access the site along railroad spurs. In the 1990s, the owners upgraded the security of the site by making improvements in the fencing and by increasing monitoring, especially with the development of the interim water treatment plant.

PATHWAYS ANALYSES

A chemical can affect people only if they contact it through an exposure pathway at a sufficient concentration to cause a toxic effect. This requires a source of exposure, an environmental transport medium, a point at which a person contacts the contaminant, a route of exposure, and an exposed population. A pathway is complete if all of its components are present and people were exposed in the past, are currently exposed, or will be exposed in the future. If parts of a pathway are absent, data are insufficient to determine if it is complete, or exposure may occur at some time (past, present, future), then a potential exposure pathway exists. If part of a pathway is not present and will never exist, the pathway is incomplete and is not evaluated further.

During years of industrial operations, air emissions, and accumulation of tons of solid wastes, the site became the source of contamination of several environmental media. The contaminants of interest in DePue are metals. The levels of volatile and semi-volatile organic chemicals were below health-based comparison values.

During rain storms, surface residues and soil contaminants can migrate in surface water runoff to sidewalks, streets, the village sanitary sewer, ditches, creeks, Lake DePue, and rivers. Once in waterways, contaminants can be transported downstream until they are deposited as sediment. In addition, rain water may percolate through contaminated surface soil and leach contaminants into groundwater beneath; however, metals do not readily leach into subsurface soils or groundwater unless acidic conditions exist. The leaching of contaminants into subsurface areas is more of a concern with chemicals found in the gypstack. A few private wells may be in this area. Once in groundwater, contaminants may migrate in the direction of groundwater flow.

Another pathway involves contaminants adsorbed to surface soils and particles that drift through the wind to nearby areas. The potential for off-site migration of wind-borne contaminated surface soil has been diminished because site owners have provided vegetative cover to prevent erosion, and apply water to the gypstack, which maintains a moistened surface and vegetative cover. In the past, industrial air emissions carried contaminants off the site, so the accumulation of metals in off-site soil was likely. Residents may track surface contamination into homes.

Once humans are exposed to a chemical in an environmental medium, absorption may occur by inhalation, ingestion, or skin contact. Heavy metals are not readily absorbed through the skin, so this exposure route will not be discussed.

A. Completed Exposure Pathways

Table 16 shows the completed exposure pathways at this site. Many of these pathways are likely to have occurred in the past, but because of cleanup activities, they may no longer be complete.

Former workers inhaled and ingested contaminants in on-site air emissions, products, and solid wastes. Presently, only a few workers are employed at the site, and their exposures are limited because of cleanup activities. All of the workers at the site have received the Occupational Safety and Health Administration (OSHA) 40-hour safety training and have access to personal protective equipment, if needed. Trained workers who follow approved cleanup procedures should not be part of a completed exposure pathway.

Trespassers may have been exposed to on-site contaminants in the past. Former residents reported that children would regularly play in waste piles. Because of improved security measures, trespassers, including children, are no longer exposed to waste pile contaminants.

On-site waste and contaminated soils containing inorganic chemicals and metals may have been transported or migrated into residential yards, gardens, low areas, and farm fields. The Illinois Department of Agriculture has approved gypsum as a soil amendment. Before the plant closed, air emissions and wind-borne particles settled onto residential surfaces including yards, streets, sidewalks, patios, and driveways. Drip-lines around homes might contain elevated levels of contaminants because rain washed residues from roofs. Past air emissions are reported to have been visible and nearly always present. Off-site migration of contaminants by wind or surface runoff may have been problematic for any of the larger piles before they were vegetated. These pathways are not problematic today because vegetative covers have been established and because a dust control program has been implemented.

Air deposition and surface runoff carried metals to waterways and served to contaminate area sediments. Dredging workers who may not have followed good work practices in the past may have incidentally ingested contaminants as they dredged Lake DePue. Residents visiting the area waterways for recreational purposes may contact contaminated sediments while fishing, hunting, swimming, or wading. A sport fish consumption advisory is in effect for this section of the Illinois River because of upstream contamination sources. This may serve as an administrative control and limit the amount of fishing in the area.

Since industrial operations ceased, exposures to air emissions are no longer a concern. Air sampling for several metals and particulates conducted by the DePue Group in recent years has shown that the dust control program has been successful.

Residues on hard surfaces or from contaminated soils can be tracked into homes. House dust can contain contaminants that can be ingested, especially by younger children. Dust from the site could have been picked up by older children playing on the site and brought home to a younger

sibling. A family pet that wanders onto the site may track contaminated residues into a home. This exposure pathway may have been more problematic in the past than today, especially since educational efforts have been made to give residents information regarding at-home dust control methods.

Another historical, completed exposure pathway is the accident spill of acid on the site in 1980 that leaked into the municipal storm sewer producing hydrogen sulfide gas in residential basements. One death was attributed to this accident.

B. Potential Exposure Pathways

Table 17 lists the potential exposure pathways that may result in some exposure for the current and future DePue residents and site workers. Because metals do not degrade, they will remain in all contaminated media until physically displaced. Contaminants that can move through the soil, like those found at the gypstack, can percolate to subsurface soils and may reach the shallow groundwater. Therefore, this pathway may be a potential problem for residents using private wells in the area north of DePue where the gypsum waste was stored. Clay was reportedly installed under at least part of the gypstack, and the clay might inhibit or hinder release of the waste to groundwater. Limited information is available regarding the extent or thickness of this clay layer.

The groundwater in the area generally moves in a southerly direction toward the lake. Groundwater is the source of DePue's municipal drinking water, which is drawn from a deep, bedrock aquifer. Heavy metals do not move readily through subsurface soils. The community has a water treatment plant regulated by Illinois EPA.

Rainwater can percolate through source areas and pick up contaminants that might eventually leach to groundwater or discharge to surface water. In addition, residual surface contaminants transported by surface water run-off might be transported to neighboring residences. These pathways could add to the sediments that exist from previous contaminant deposition. A ditch on the northern bank of Lake DePue contains unnatural sediment and water that is carried to waterways as run off. Sediment transport may be accelerated during periods of excessive rainfall.

In the past, individuals might have been exposed to soil contamination and waste residues on the site primarily from activities involving disturbing, moving, or grading solid waste and contaminated soils. Exposure to trespassers may have also occurred in the past but is unlikely today because site security has greatly improved and community educational efforts have warned against trespass onto contaminated areas.

Lake DePue and the nearby Illinois River are used for recreation. No community water supplies in the area draw from Lake DePue. IDNR is conducting independent assessments of these properties and some of its associated biota. Discussions regarding the remediation of sediments

and contaminated soils in the conservation areas and in private properties are ongoing. Other agencies are gathering data and information regarding the impacts on wildlife. Once this information is available, more will be known regarding the potential present and future exposure pathways.

PUBLIC HEALTH IMPLICATIONS

This section includes discussions on potential health effects in persons exposed to specific site-related contaminants and addresses specific community health concerns.

A. Toxicology Evaluation

ATSDR developed Minimal Risk Levels (MRLs) to help evaluate whether an exposure to a contaminant warrants further examination for potential health effects. An MRL is an estimate of the daily human exposure to a contaminant below which adverse, noncancerous health effects are not likely to occur. MRLs are screening values developed for different routes of exposure, including ingestion and inhalation, and for three different exposure periods: acute (less than 14 days); intermediate (15-365 days); and chronic (more than 365 days). When an MRL was not available for a contaminant of concern, a USEPA Reference Dose (RfD) was used.

To help evaluate health effects, ATSDR presents information and study data summaries on specific chemicals in Toxicological Profiles. IDPH used ATSDR Toxicological Profiles to help evaluate exposures to contaminants of interest at this site. The number of contaminants of interest may change when more information becomes available.

Much of the toxicological information presented in this section focuses on potential site-related exposures. Frequently, adverse human health effects are known only from occupational exposure situations where individuals have been exposed to very high levels of chemicals. Often, human comparison values are developed using information obtained from laboratory animal studies, so safety factors are included in these calculations. The probability that an adverse health effect will occur is dependant upon the exposure concentration, how the exposure occurs (ingestion, inhalation, dermal contact), and the amount of time an individual is exposed. For this site, the focus will be the residential DePue population.

The organic chemicals measured in the 1992 samples were found at levels below comparison values and are not discussed in this section because any exposure to them would not be expected to cause adverse health effects (Table 15).

Metals are the contaminants present in completed exposure pathways. Metals are not appreciably absorbed through the skin, and ambient air is not a current completed pathway; therefore, the discussion in this section focuses on the residential population's ingestion of contaminants

through hand-mouth behavior. We compared all the metals detected in the residential soil samples to health-based levels determined for adults, children, and pica children. The residential soil levels were used because those levels were higher than the carpet and indoor dust levels. A number of metals were eliminated from further evaluation because exposure to them at the concentrations found in the 1992 analyses of off-site surface soils (Table 3) is not expected to cause adverse health effects.

IDPH developed an exposure scenario for incidental soil ingestion for children playing outdoors in contaminated residential areas. For these potential residential exposures, we assumed that a 16-kilogram child would play outdoors at least 4 days a week for 39 weeks per year for about 5 years. A typical child would incidentally ingest 200 milligrams of soil daily, whereas a child with a propensity to mouth non food items (pica behavior) would ingest 5,000 milligrams of soil daily. Children would not likely be exposed to contaminated soil during the winter. No adjustment were made for the increases in children's body weight for the five-year scenario.

The estimated exposures were calculated and listed for the range of residential soil concentrations and were included in Table 18. Exposure to contaminants in soil is much more likely in yards with poor vegetative cover. Adult residential exposure levels would be lower than those calculated for a normal child, and exposure is more likely for individuals who work in their yards. Several metals do not appear to exceed health guidelines for exposures to contaminated residential soil. The metals of interest that may exceed health guidelines include arsenic, barium, cadmium, chromium, lead, manganese, vanadium, and zinc. A discussion of exposure to those metals is presented in alphabetical order.

Arsenic

Arsenic was present in residential surface soil at an estimated range of 4.7 to 32.4 ppm, which is within background levels found in some areas of the United States. Typical children would not receive an estimated dose that exceeds the MRL; however, a child who exhibits pica behavior (eating non food items) may ingest a dose that exceeds the MRL (Table 18). The exposure to adults would not exceed health guidelines.

At 0.072 mg/kg/day, ingestion of arsenic may irritate the stomach and intestines, and vomiting and diarrhea may result. That dose is about an order of magnitude higher than the estimated dose for a pica child. Long-term exposures at 0.05 mg/kg/day could decrease the production of blood cells. That is also about an order of magnitude greater than the estimated dose for a pica child. Skin changes have been seen at 0.29 mg/kg/day (ATSDR, a1998). Ingestion of arsenic over time has also been associated with skin cancer. Historically, arsenic has been associated with intentional poisoning. However, some researchers believe that small amounts of arsenic (10 - 50 parts per billion) may be beneficial to health. It is naturally found in soil, water, and food (ATSDR, a1998).

Barium

Barium was estimated in residential soils at a range of 88.2 to 8,710 ppm. Pica children playing in the areas with the highest concentration of barium would exceed the USEPA RfD. Little is known about the health effects of barium exposure in humans. Some researchers have attributed difficulties in breathing, blood pressure, and cardiovascular problems with barium exposure. In rats, breathing and cardiovascular problems developed with a dose of 198 mg/kg/day, which is considerably higher than the 1.2 mg/kg/day estimated dose for a pica child (ATSDR, a1990). No human data are available. Barium has also been measured in concentrations above background levels in solid waste and sediments on site properties and in off-site sediments.

Cadmium

Children playing in contaminated residential soil regularly could ingest enough cadmium to exceed the MRL. This would be more likely to occur in play areas without any ground cover.

No historical biological or exposure data were found for former workers. Zinc ores processed in years gone by at this site apparently contained relatively large concentrations of cadmium. Workers on site today receive training on personal protection and good work practices. Dust control programs appear to have been effective in controlling the levels of metals in ambient air and limiting wind erosion via fugitive dust.

The human body does not readily take up cadmium from the gastrointestinal tract. An estimated 90% of the cadmium ingested is not absorbed. Cadmium has no known beneficial health effect and, with long-term ingestion, too much can accumulate in the kidneys and in the bones and damage them. No information on what doses cause less serious health effects was found for humans. Hypertension was seen in rats who ingested 0.0089 mg/kg/day for five months (ATSDR , a1997). That is the same order of magnitude of the estimated dose for a pica child, but it is an order of magnitude more than the estimated exposure dose for a typical child.

The IDPH biological screening in 1993 (see *Health Outcome Data Evaluation* section and Tables 12, 13, and 14) did not find any children with elevated cadmium blood or urine levels among the DePue volunteers. Only one adult worker, who currently works at a facility known to use cadmium, had an elevated blood cadmium concentration. One retired senior citizen with a smoking history had an elevated urine cadmium level. Cadmium exposure has been associated with cigarette smoking. Cadmium was found in house dust in some DePue homes. There are no standards for cadmium in dust similar to those developed for lead dust.

Cadmium is also known to be taken up into garden vegetables under some soil conditions. Different plants can absorb different amounts of cadmium, depending upon the soil type, soil

acidity, the amount of organic matter present, other metals present, and other inorganic compounds available (ATSDR, a1997). We do not have data on garden soil conditions from DePue or what levels of metals may be present in locally-grown vegetables.

Because of the multiple potential sources for cadmium, the length of time metals have contaminated the environmental media, the concentrations of cadmium found in some off-site properties, and the inherent toxicity and cumulative nature of this metal, cadmium is a contaminant of interest at this site.

Chromium

There are several forms of chromium found in the environment including chromium III and chromium VI. Chromium III is the naturally-occurring form and is an essential nutrient. Chromium VI is usually associated with industrial activities and is more toxic than chromium III. The analyses reviewed here measured total chromium and did not differentiate between the two types. The comparison values used are based on chromium VI. Only a pica child playing in the most contaminated residential area would exceed the USEPA RfD. Chromium has been associated with redness and swelling of skin in allergic individuals at 0.036 mg/kg/day, which is an order of magnitude greater than the estimated exposure dose for a pica child (ATSDR, b1998). Some people may be sensitized to chromium and might experience effects at a lower exposure dose than most people. However, for most of the population of DePue, no adverse health effects would be expected.

Lead

ATSDR has no health guidelines for lead. Lead levels on the site are greater than levels that USEPA has used as a cleanup level for industrial areas. We do not know what levels in the environment can increase blood lead levels in people upon exposure. Changes in the blood have been seen at 0.02 mg/kg/day (ATSDR, b1997).

Lead in residential soils was greater than 400 ppm, which is sometimes used by USEPA as a cleanup level for residential soil. Lead was also present in indoor dust, which provides another potential exposure source. Additionally, people were historically exposed to lead from the facility when it was in operation. The type of lead present in the soil, air, and dust is important because some compounds of lead are more readily absorbed by the body than others; however, these analyses were not completed during the sampling events reviewed.

Only one child had an elevated blood lead level when IDPH tested area volunteers for lead. Further investigation of the child's environment suggested that lead dust from old paint may have contributed to the blood lead level. The exterior of the child's home had been scraped and painted, and visible paint chips were evident around the foundation of the home.

Children exposed to lead before they are born and young children exposed to lead can exhibit a decrease in their IQ (Intelligence Quotient) and may exhibit behavioral problems (ATSDR, 1988). Lead is stored in the bone. Women who were exposed to lead in the past can pass lead to their unborn child when lead stores are released from the bones to the blood stream and cross the placenta (ATSDR, b1997). Because of the serious adverse health effects that could occur from lead exposure to young children, lead is a contaminant of concern.

Manganese

Low levels of manganese are thought to be necessary for maintaining health. Since manganese is a naturally occurring element, the amount in the normal diet is between 2,500-5,000 mg/day (ATSDR, c1997). Based on the data reviewed, manganese is not expected to be a health concern for adults or typical children in DePue. Pica children playing in the most contaminated residential soils may ingest excess manganese. The health effects associated with the ingestion of manganese may include weakness, trembling, and stiff muscles. Mild neurological signs have been seen in people who consumed 0.059 mg/kg/day for 50 years (ATSDR, c1997).

Vanadium

Pica children may exceed the MRL for vanadium if they play regularly in yards with elevated levels of this metal. Typical children and adults would not be expected to exceed this health guideline. Little information exists about human health effects associated with long-term oral exposure to this metal. The main health effects are due to inhalation exposure. Animal studies have associated some kidney effects associated with vanadium. Rats fed 0.57 mg/kg/day for three months experienced some kidney effects (ATSDR, b1990). That is two orders of magnitude greater than the estimated exposure dose for a pica child.

Zinc

Adults or typical children exposed to the maximum levels of zinc found in residential yards would not receive a dose associated with adverse health effects. Pica children may exceed the current MRL for zinc. Zinc is found at very high concentrations in most areas tested around the former smelting operations and on-site properties. Residents reported that in the past, children would play on waste piles for recreation. No information regarding workers exposures during the peak years of operations is known to exist.

Zinc remains a contaminant of interest because it is found at such high concentrations in all the environmental media tested. It was also measured in house dust in some DePue homes. Because of the multiple sources, exposure levels may be higher for some people. Zinc is an essential nutrient, but ingestion of levels greater than in a normal diet or vitamin pill, ranging from 5 mg/kg/day for infants to 15 mg/kg/day for an adult male, can cause some people to experience nausea and anemia (ATSDR, 1994). Zinc is not believed to cause cancer.

B. Health Outcome Data Evaluation

In response to questions regarding cancer rates, the IDPH Division of Epidemiological Studies published a cancer incidence report in February 1994. Forty cases of cancer were observed within the DePue zip code area, 61322, with 45 cases expected. This difference was not statistically significant.

To determine if an immediate public health hazard existed under current exposure conditions, IDPH conducted blood and urine screening in September 1993. One hundred ten participants volunteered to provide venous blood samples and random urine samples. These were sent each day by courier to a commercial clinical laboratory.

Of the 106 whole blood samples analyzed for cadmium, one adult had a slightly elevated level (Table 12), a blood cadmium concentration greater than 5 micrograms per liter (μg/L) (U.S. Department of Labor, 1990). This adult was working with cadmium in the work place at the time of the investigation.

Of the 33 random urine samples analyzed for cadmium, 28 had no detectable levels of cadmium (Table 13). Of the five detectable results, four adults were more than 70 years of age. To compare these results with the current cadmium standards developed for worker exposure, urine creatinine was also measured in these 33 samples and the results were normalized. One adult had a normalized urine sample greater than the national worker standard of 3.0 μg cadmium per gram of creatinine (U.S. Department of Labor, 1992). This adult had smoked cigarettes for more than 30 years and had worked at the site for more than 40 years. Older participants had more frequent detections than younger participants, which is a typical finding in measurements of biological metal concentrations and is often attributed to exposures from common sources.

Lead was measured in 109 whole blood samples from volunteers (Table 14). The mean and the median for all blood lead samples were 3.4 μg/dL and 2.7 μg/dL, respectively. This is similar to the blood lead mean of 2.8 μg/dL from 12,119 participants of all races aged 1-74 years during the third National Health and Nutrition Examination Survey conducted from 1988 to 1991 (Pirkle, 1994). Of the 109 volunteers, one child had a blood lead level greater than 10 μg/dL, the Centers for Disease Control and Prevention's level of concern for children. An investigation conducted at this child's home determined that recent renovations had disturbed some lead painted surfaces. No child less than 6 years of age in the DePue investigation had a blood lead level greater than 10 μg/dL. In Illinois, 8.5% of children less than 6 years of age had at least one result of 15 μg/dL, for a total of 18,537 children (IDPH, 1997). A lead exposure study conducted near a closed, secondary lead smelter by IDPH and ATSDR in 1991 included blood samples collected from 490 children under the age of 6 with a mean of 6.9 μg/dL (ATSDR, 1995). Not one participating adult in the DePue investigation had a blood lead level greater than 25 μg/dL, the currently acceptable level for adults.

The biological screening for cadmium and lead exposures did not show an immediate public health hazard. IDPH provided those results to Illinois EPA staff who had originally asked whether the site required an emergency cleanup. The elevated metal levels found in three individuals cannot be solely attributed to industrial or environmental exposures because of additional occupational and household metal sources. The lead and cadmium tests performed only capture information on recent exposure. The tests do not indicate what may have accumulated in the body as a result of past exposure.

In the mid 1990s, community members informed IDPH that nine individuals had been diagnosed with MS (MS). In response to this concern, IDPH contracted with the University of Rochester to confirm these cases and compare this local incidence rate of MS with typical rates. They concluded that a significant excess of MS cases existed during the period investigated (1971-1990). The reasons for the excess of MS cases are not known. The final report provided to IDPH discussing those findings is included as Attachment 1.

COMMUNITY HEALTH CONCERNS

People have raised several issues during public meetings, discussions during a door-to-door survey, meetings with local agency and community leaders, and health professional workshops. Residents asked about exposures to the discolored water that used to pool along the sidewalk on Marquette Street. The DePue Group has remediated the problem of the accessible standing water. People living around the site had some questions about cancer, which were addressed by the 1994 IDPH cancer incidence report.

Former Bureau County Health Department staff and local health care providers have expressed a concern about individuals receiving dialysis treatment. Some residents have expressed concern about the number of MS cases in the area. Family members who lived near the gypsum waste stack north of town have asked about the potential health effects from living near the large pile of inorganic wastes. One individual reported to have an allergy to metals and questioned if growing up in this area contributed to this medical condition.

Question: What health effects are associated with cadmium exposure and how can a doctor test patients for cadmium?

Response: The principal target organ from cadmium exposures is the kidney. The kidneys not only store cadmium for long periods, but if enough metal accumulates, kidney disorders can result. The bones do not store cadmium but can be adversely affected by long-term cadmium exposures. The skeletal effects are often called "itai-itai" or "the fragile bone disease." The estimated exposure dose that people living around the site might receive is much less than the doses associated with that disease. The liver also stores cadmium for long periods.

Clinical investigations usually consist of the measure of cadmium concentrations in body fluids and tissues including blood, urine, hair, nails, or biopsies of the kidney or liver. Kidney and liver function tests can be undertaken, but abnormal results do not prove that an excessive body burden of cadmium exists.

Information on cadmium exposure has been discussed at public meetings, community gatherings, and at two ATSDR-sponsored health professional educational workshops at area hospitals.

Question: Are the private wells north of Route 29 contaminated?

Response: Those wells are upgradient of the former operations area but might not be well isolated from the gypstack. The wells are not likely to contain site-related heavy metals. To verify that, IDPH recommends that the functional private wells be tested for the wastes found in the stack. Abandoned wells should be properly sealed.

Question: Are there more persons in the DePue area on kidney dialysis than would be expected? If so, could this be related to the site?

Response: IDPH does not know because we have not found any agencies or programs that collect records on dialysis use. Long-term cadmium exposure can have adverse effects on the kidney. Those people who were tested for cadmium exposure did not have an excess of cadmium that could be attributed to cadmium from the site.

Question: Nine individuals who grew up in DePue have been diagnosed with MS as adults. Why?

Response: No one knows the specific cause of this neurological disorder, although many medical researchers have developed several hypotheses. IDPH worked with a neurologist with experience treating MS patients to statistically evaluate the local incidence rate of the confirmed cases and to compare it to incidence rates found elsewhere. An elevated rate was found, and the report discussing those findings is included as Attachment 1.

CONCLUSIONS

IDPH considers the site a public health hazard because of the potential exposures to contamination in surface soils and sediments and because of the likely long-term past exposures. Long-term past exposures to workers and residents in DePue were likely, and conditions still

exist that could result in additional exposures. The opportunity for people to be exposed to contaminants on site have decreased because of security measures that have been implemented.

The contaminants of interest include metals that are found at elevated levels in residential soils. Cadmium and lead are the nonessential heavy metals known to accumulate in humans and other animals that are present at concentrations that could result in adverse health effects because of the cumulative nature of the metals. Excessive internal accumulation of cadmium can lead to kidney and skeletal disorders, and excessive lead exposure is especially damaging to young children. Because of the cumulative nature of cadmium and lead, former workers and long-time residents may have elevated body burdens accumulated during their lifetimes, and any subsequent exposures have the potential to result in adverse health effects. Biological screening for cadmium and lead in 1992 did not measure any exposures experienced by the group of volunteers that could be attributed to site conditions. Those tests only capture recent exposures to lead and cadmium and do not provide information on historical exposure.

No information is available on whether garden products contain cadmium, and information on residential soil lead and cadmium levels is limited.

Although private wells appear to be upgradient of source areas, some wells near the gypstack may not be geologically isolated from that area.

New information generated during the on-going cleanup efforts and RIs will be reviewed by IDPH as it becomes available.

RECOMMENDATIONS

Cease/Reduce Exposure Recommendations

1. The site properties need continued security to prevent access to wastes.

2. Education of residents should continue regarding methodologies to reduce exposures to environmental contamination in residential soil.

Site Characterization Recommendations

1. Soil samples from concerned citizens' properties and gardens should be collected and analyzed.

2. Private wells near the gypstack should be surveyed. If any potable wells are identified, they should be sampled for the inorganic compounds found in this area.

Public Health Action Plan

Actions Completed

1. Blood lead and urine cadmium samples have been collected from a group of residents who live near the site. The biological testing was to determine if immediate measures were necessary to remove contamination to stop exposure. The testing showed that no current exposure was occurring that would warrant emergency action.

2. Information has been distributed to residents around the facility, especially those with high levels of lead, cadmium, and zinc in their yards, on how to clean their homes and how to prevent tracking contaminated soil and dust into their homes. The information has been provided in English and in Spanish to be sure that all residents understand the written materials. Additionally, interpreters have been provided in public meetings to be sure that residents understand verbal information provided and to ensure everyone's concerns are understood.

3. To address community concerns regarding multiple sclerosis among residents, IDPH arranged to have cases confirmed. That information is presented in an attachment to this document.

Actions Planned

1. Both USEPA and Illinois EPA are aware of community concern about contamination on residential properties and of IDPH's recommendation to sample those areas if requested. If yards and garden soils are sampled and analyzed, IDPH will provide property owners with the results and with appropriate consultation.

2. IDPH will continue with community health education to inform residents on how they can reduce their exposure to contaminated soils and dusts.

3. IDPH will work with Illinois EPA to see if private drinking water wells are in the area that could be affected by the gypstack. If so, IDPH will work with Illinois EPA to sample those wells for contamination. IDPH will provide well owners with the results.

4. IDPH will continue to evaluate this site for appropriate health follow-up activities as additional environmental data and information become available.

ATSDR CHILD HEALTH INITIATIVE

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances emitted from sites. They are more likely exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which means they can breathe in any dusts close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Also, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

IDPH evaluated the likelihood for residents living near the site to be exposed to lead at levels of health concern. Historically, children, who are now adults, were likely exposed to chemical contaminants at higher levels than they are presently. Soil lead levels in residential properties do not appear to be at concentrations that would elevate residents' blood lead levels. Still, metals in soils and sediments present sources of exposure for area children; however, in the future, exposures should decrease as remediation and educational efforts continue.

PREPARERS OF REPORT

Preparer

Catherine Copley
Environmental Toxicologist
Illinois Department of Public Health

Reviewer

Ken Runkle
Environmental Toxicologist
Illinois Department of Public Health

ATSDR Regional Representative

Louise Fabinski
Regional Operations
Office of the Assistant Administrator

ATSDR Technical Project Officers

Gail Godfrey
Division of Health Assessment and Consultation

Steve Inserra
Division of Health Studies

Courtney Wilson
Division of Health Education and Promotion

REFERENCES

Agency for Toxic Substances and Disease Registry (1988) The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress. Atlanta, Georgia.

Agency for Toxic Substances and Disease Registry (a1990) Toxicological Profile for Barium (Draft for Public Comment). Atlanta, Georgia. October 1990.

Agency for Toxic Substances and Disease Registry (b1990) Toxicological Profile for Vanadium (Draft for Public Comment). Atlanta, Georgia. October 1990.

Agency for Toxic Substances and Disease Registry (1992) Health Consultation of July 28, 1992 with IDPH regarding DePue, Illinois.

Agency for Toxic Substances and Disease Registry, Public Health Assessment Guidance Manual (1992) Atlanta, Georgia. March 1992.

Agency for Toxic Substances and Disease Registry (1994) Toxicological Profile for Zinc (Update). Atlanta, Georgia. May 1994.

Agency for Toxic Substances and Disease Registry (a1997) Draft Toxicological Profile for Cadmium (Update). Atlanta, Georgia. September 1997.

Agency for Toxic Substances and Disease Registry (b1997) Toxicological Profile for Lead (Update) (Draft for Public Comment). Atlanta, Georgia. August 1997.

Agency for Toxic Substances and Disease Registry (c1997) Toxicological Profile for Manganese Update) (Draft for Public Comment). Atlanta, Georgia. September 1997.

Agency for Toxic Substances and Disease Registry (a1998) Toxicological Profile for Arsenic (Update) (Draft for Public Comment). Atlanta, Georgia. August 1998.

Agency for Toxic Substances and Disease Registry (b1998) Toxicological Profile for Chromium (Update) (Draft for Public Comment). Atlanta, Georgia. August 1998.

Agency for Toxic Substances and Disease Registry (1999) Health Guidelines Comparison Values (First Quarter of 1999). U.S. Department of Health and Human Services.

Ecology and Environment (1993) Site Assessment Report for NJ Zinc. Report for the USEPA Technical Assistance Team. Chicago, Illinois. July 29, 1993.

Gibb, JP and K Cartwright (1982) Retention of Zinc Cadmium, Copper, and Lead by Geological Materials. Cooperative Groundwater Report 9, Illinois State Water and Geological Surveys.

Golder Associates, Incorporated (1997) Focused South Ditch Remedial Investigation: DePue Site, DePue, Illinois. Prepared for the DePue Group. Chicago, Illinois. July 1997.

Illinois Department of Nuclear Safety (1992) Results of radium survey. Letter from Richard Allen, Office of Environmental Safety to L. Hinson, Mobil Mining and Mineral Company. Dated May 6, 1992.

Illinois Department of Public Health (1994) Incidence of Cancer in DePue (Bureau County), Illinois from 1987-119. Division of Epidemiologic Studies. February 1994.

Illinois Department of Public Health (1994) Lead Poisoning Prevention Act (410 ILCS 45) and Code (Part 845 dated December 31, 1994) and Division of Environmental Lead Program Policies and Procedures. Springfield, Illinois.

Illinois Department of Public Health (1996) Memo to ATSDR dated August 16, 1996 regarding health concerns in DePue, Illinois.

Illinois Environmental Protection Agency (1975) NJ Zinc site visit. Division of Water Pollution Control. Rockford, Illinois. July 12, 1975.

Illinois Environmental Protection Agency (1978) Assessment and classification of Illinois Lakes. Volume 2. Springfield, Illinois.

Illinois Environmental Protection Agency (1982) NJ Zinc Company Hazardous Ranking Scoring package.

Illinois Environmental Protection Agency (1983) Preliminary Assessment: Potential Hazardous Waste Site. Reviewed by Ecology and Environment with Illinois EPA Rockford Office. July 13, 1983.

Illinois Environmental Protection Agency (1992) CERCLA Expanded Site Inspection Report for DePue/NJ Zinc/Mobil Chemical site (Draft). Springfield, Illinois.

Illinois Environmental Protection Agency (1993a) Site Inspection Document: NJ Zinc/Mobil Chemical/DePue. Bureau of Land Remedial Project Management Section. May 18, 1993. Springfield, Illinois.

Illinois Environmental Protection Agency (1993b) DePue Sampling Point Locations of April 29, 1993 and Analytical Results. Correspondence from Richard M. Lange, Illinois EPA Project Manager.

Illinois Environmental Protection Agency (1994) Illinois Water Quality Report 1992-1993. Bureau of Water. Document Illinois EPA/WPC/94-160. August 1994.

Illinois Environmental Protection Agency (1996) Illinois Water Quality Report 1994-1995. Bureau of Water. Document Illinois EPA/BOW/96-060a. September 1996.

Illinois Environmental Protection Agency (1997a) Interim Water Treatment System fact sheet. Springfield, Illinois. February 1997. Data on three groundwater sources sampled January 19, 1996.

Illinois Environmental Protection Agency (1997b) DePue Wildlife Management Area: Illinois Department of Natural Resources fact sheet. Springfield, Illinois. November, 1997. Information on IDNR investigation.

Illinois Pollution Control Board. PCB 88-130 Variance granted in report of January 19, 1989.

Illinois State Geologic Survey (1986) Inorganic Composition and Sedimentation Rates of Backwater Lakes Associated with the Illinois River. Richard Cahill and John Steele. Environmental Geology Note 115. Champaign, Illinois.

Terra Environmental Services (1995) Site Assessment Plan for the DePue Site, DePue, Illinois. Prepared for the DePue Group. December 6, 1995 Draft. Tampa, Florida.

Terra Environmental Services (1996) Letter to Richard Lange, Illinois EPA: Summary of Air Monitoring Program. November 14, 1996. Tampa, Florida.

U.S. Bureau of the Census (1990) 1990 Census of the Population and Housing of the United States: DePue, Illinois.

U.S. Department of Labor (1992) Occupational Safety and Health Administration Occupational Exposure to Cadmium: Final Rule, 29 CFR Parts 1910, 1915, and 1928; also 29 CFR 1926.42224, Washington, D.C., September 14, 1992.

U.S. Environmental Protection Agency (1984) Potential Hazardous Waste Site: Preliminary Assessment. Mobil Chemical Corporation. Ecology and Environment, Inc., Chicago, IL completed form 2070-12 for U.S. EPA Region V, transmittal memo dated July 13, 1983.

U.S. Environmental Protection Agency (1993) Site Assessment Report for NJ Zinc, DePue, Bureau County, Illinois. E & E Technical Assistance Team (TAT), July 29, 1993.

U.S. Environmental Protection Agency (1993) 1990 Toxic Chemical Release Inventory. National Library of Medicine's TOXNET System.

U.S. Department of Health and Human Services (1991) Preventing Lead Poisoning in Young Children. Public Health Service, Centers for Disease Control. Atlanta, Georgia.

U.S. Food and Drug Administration (1993) Public Health Service investigation of Lake DePue fish. Letter dated January 12, 1993 with results of October 1992 fish collection.

Village of DePue (1996) Letter to Gov. Jim Edgar from Village Board Members. March 1, 1996.

TABLES

Table 1. Inorganic Concentrations in DePue On-site Solid Waste Materials (in ppm).

	Gob Pile X112-X113 3-92 ZN10 3-93	**Lithopone Ridges** X114-X115 3-92 LP20 3-93	**Catalyst Waste** DC10 3-93	**Waste/Fill East** Creek X116 3-92 SM40 3-93	**Gypstack** X107 3-92 GY30 3-93
Aluminum	NA 14,500-23,500	11,100-11,200 1,500	720	6,870 6,400	855 1,100
Antimony	<7.8-<8.4 57	R-R 18	<0.2	<5.7 34	R 3.0
Arsenic	144-164 93	5.1-236 6.2	140	124 61	<0.31 <0.75
Barium	111-140 160	291-121,000 14,000	27	993 36	22.9B 24
Beryllium	1.1-1.0 0.06	0.74-1.5 0.16	24	0.63B 0.039	<0.15 0.099
Boron	NA 12	NA 7.0	4.8	NA 15	NA 35
Cadmium	365-591 71	105-<0.96 8.8	3.0	81.9 97	<0.77 0.98
Calcium	9,580-12,000 17,000	1,760-10,100 2,300	1,800	5,320 12,000	125,000 52,000
Chromium	34.9-38.3 12	25.9-46.4 9.5	69	593 11	2.6 5.3
Cobalt	31.6-62.0 18	40.9-<0.58 9.6	1.7	26.9 11	<0.46 0.47
Copper	6,200-8,070 1,900	262-5,900 50	28	2,040 740	1.5B 2.8
Cyanide	14.4-30.0 R	17.6-<1.6 R	R	1.0 R	<1.2 R
Iron (total)	103,000-126,000 45,000	22,800-126,000 14,000	19,000	56,000 30,000	706 1,300
Lead	3,040-7,030 1,900	834-3,656 250	230	4,400 1,900	6.7 3.5
Magnesium	829-1,940 8,200	923-5,840 700	570	2,530 5,899	40B 320
Manganese	2,820-3,140 870	327-1,560 250	42	1,550 1.3	3.6 16
Mercury	<0.17-<0.12 0.4	<0.48-<0.16 0.01	0.1	4.39J 2.8	<0.12 0.03

	Gob Pile X112-X113 3-92 ZN10 3-93	**Lithopone Ridges** X114-X115 3-92 LP20 3-93	**Catalyst Waste** DC10 3-93	**Waste/Fill East** Creek X116 3-92 SM40 3-93	**Gypstack** X107 3-92 GY30 3-93
Molybdenum	NA <0.5	NA <0.5	9.1	NA 4.9	NA 0.65
Nickel	27.9-34.4 12	32.1-32.4 30	3.3	411 15	<2.0 1.5
Potassium	320-1,500 920	273-3,060 134	6,200	1,010 1,200	<100 510
Selenium	35.0-13.3 <0.6	0.66-13.9 <0.6	<0.6	5.8 <0.6	R <0.6
Silicon	NA <0.5	NA <0.5	<0.5	NA <0.5	NA 1,000
Silver	17.2-45.9 12	3.6-53.7 <0.05	<0.05	21.3 7.2	0.81B <0.05
Sodium	<849-1,130 140	<252-<614 48	38	263B 160	258B 440
Thallium	<0.56-R 5.2	R-R 1.1	59	R 3.4	R 5.5
Vanadium	47.3-53.5 17	54.3-101 1.2	9,000	26.8 17	2.4 9.2
Zinc	105,000-148,000 15,000	656-19,300 1,100	270	22,500 21,000	<6.9 21

B = analyte found in blank
NA = not analyzed
U =not detected
R = data rejected
ppm = parts per million

Table 2. Inorganic Concentrations in DePue On-site Soils (in ppm).

	TPA1 8-94	TPA2 8-94	TPA3 8-94	0-6" X109 3-92	2-6" X111 3-92	<1 ft X110 3-92	<1 ft ISGS1 W plant area	<1 ft ISGS4 S of gob pile	<1 ft ISGS6 S of Marq to E	<1 ft ISGS7 Old dump area	Background Tiskilwa 3-92 X101 & X102
Aluminum	NA	NA	NA	5,620	6,130	9,280	NA	NA	NA	NA	8,750-11,000
Antimony	NA	NA	NA	R	R	ND	NA	NA	NA	NA	ND-6.6J
Arsenic	NA	NA	NA	14.3	113	268	NA	NA	NA	NA	4.5-6.0
Barium	NA	NA	NA	56.9	4,860	3,510	NA	NA	NA	NA	104-174
Beryllium	NA	NA	NA	0.35	1.4	1.5	NA	NA	NA	NA	0.56-0.74
Cadmium	NA	NA	NA	20.6	55.0	278	84 (1')	1,400 (3')	27 (1')	300 (5')	0.68-0.71
Calcium	NA	NA	NA	81,100	4,820	4,340	NA	NA	NA	NA	7,020-13,400
Chromium (total)	NA	NA	NA	11.4	28.4	20.9	NA	NA	NA	NA	14.2-19.2
Cobalt	NA	NA	NA	5.6	10.4	30.4	NA	NA	NA	NA	5.2-6.0
Copper	1,100	2,400	190	94.1	717	1,960	3,200 (1')	3,500 (1')	90 (1')	720 (1')	13.7-23.6
Cyanide	NA	NA	NA	ND	ND	ND	NA	NA	NA	NA	ND
Iron (total)	NA	NA	NA	14,100	199,000	64,700	NA	NA	NA	NA	10,600-16,100
Lead	NA	NA	NA	155	33,400	17,800	37,000 (1')	16,000 (3')	250 (1')	3,300 (1')	117-207
Magnesium	NA	NA	NA	37,100	663	1,590	NA	NA	NA	NA	3,290-6,440
Manganese	NA	NA	NA	444	1,870	2,830	NA	NA	NA	NA	382-576
Mercury	NA	NA	NA	ND	ND	0.77J	NA	NA	NA	NA	ND-ND
Nickel	NA	NA	NA	10.7	13.9	24.3	NA	NA	NA	NA	11.9-15.6
Phosphorus	800	1,100	280	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	140	<100	<100	1,460	704	982	NA	NA	NA	NA	1,900-2,740
Selenium	NA	NA	NA	ND	2.1J	8.2	NA	NA	NA	NA	0.17-0.37
Silver	NA	NA	NA	1.9	26.9	34.5	NA	NA	NA	NA	ND-ND
Sodium	NA	NA	NA	161	ND	ND	NA	NA	NA	NA	ND-140
Vanadium	NA	NA	NA	14.6	30.9	34.2	NA	NA	NA	NA	20.5-25.5
Zinc	40,000	46,000	60,000	4,510	22,900	65,600	33,000 (1')	29,000 (1')	2,600 (1')	52,000 (1')	124-296

NA = not analyzed ND = not detected ppm = parts per million

Table 3. Inorganic Concentrations in DePue Residential Soils (in ppm). Results of Illinois EPA, March 1992 Sampling.

Metal	Perimeter area 124,126,132-137	South 125, 127,128,129	East 118,119, 120,121,122,123	West 130,131	Background 101 & 102	Soil Comparison Values - ATSDR			Source
						Pica Child	Child	Adult	
Aluminum	6,470-15,300	10,100-20,100	11,900-17,600	9,360-11,600	8,750-11,000	none	none	none	
Arsenic	4.7J-16.9J	13.7J-21.4J	9.3-27.2J	17.6J-32.4J	4.5-6.0	0.6	20	200	RMEG
Barium	88.2-5,560	223-3,760	204-996	6,300-8,710	104-174	100	4,000	50,000	RMEG
Beryllium	0.44-0.83	0.66-0.77	0.58-0.86	0.59-0.68	0.56-0.74	4	100	1,000	RMEG
Cadmium	22.2J-98.1J	4.3J-97.3J	4.6J-53.1J	73.6J-90.2J	0.68-0.71	0.4	10	100	CEMEG
Calcium	4,710-48,600	2,810-15,800	2,220-29,300	15,100-7,360	7,020-13,400	none	none	none	
Chromium	13.8-25.4	17.3-26	18.2-38.8	16.2-17.3	14.2-19.2	6	200	2,000	RMEG VI
Cobalt	4.9-8.2	6-9.2	7.3-10.3	3-4.6	5.2-6.0	none	none	none	
Copper	26.8J-163J	15.4J-82.7	17.7J-115J	61.7J-65.5J	13.7-23.6	none	none	none	
Iron	10,800-19,900	19,300-20,500	13,900-23,100	14,900-15,800	10,600-16,100	none	none	none	
Lead	85.9-440	38.4-729	136-512	542-565	117-207	none	none	none	
Magnesium	1,980-24,300	1,920-5,320	2,350-17,600	6,040-4,090	3,290-6,440	none	none	none	
Manganese	305-580	110-1,040	738-1,180	532-604	382-576	300	700	100,000	RMEG
Nickel	9.9-18.6	16.5-20.3	14.7-21.1	11.8-12.5	11.9-15.6	40	1,000	10,000	RMEG
Potassium	1,320-3,300	870-2,780	1,930-3,880	1,920-2,270	1,900-2,740	none	none	none	
Selenium	0.17J-1.4J	0.33J-1.1J	0.29-1.3	1J-1.1	0.17-0.37	10	300	4,000	CEMEG
Silver	ND-1.3J	ND-1.4J	ND-1.6J	ND-ND	ND-ND	10	300	4,000	RMEG
Vanadium	18.6-35.8	29.3-42.5	30.4-41.4	23.8-24.3	20.5-25.5	6	200	2,000	RMEG
Zinc	1,.490-6,580	329-6,030	467-3,070	3,780-5,290	124-296	600	20,000	200,000	CEMEG

J=estimated value NA = not analyzed ND = not detected
VI = Chromium comparison value listed for hexavalent chromium

Table 4. Inorganic Concentrations in DePue Residential Soils (in ppm). Results of IDPH, December 1992 Sampling (in ppm).

Metal (sampling depth)	n	Min	Max	Sum	Mean	Median	Comparison Concentrations					
							Soil backgrounds			Soil Comparison Values		
							Local	Illinois ranges		Pica child	Child	Adult
								Urban	Rural			
Cadmium (0-1")	65	<5	9,100	28,763	442	100	0.68-0.71	<2.5-8.2	<0.2-5.2	0.4	10	100
Cadmium (1-2")	20	4	98	980	49	50						
Lead (0-1")	65	46	7,355	43,255	666	459	117-207	4.7-647	<7.4-270	NA	1,000	NA
Lead (1-2")	20	36	729	6,081	304	312						
Zinc (0-1")	65	3,000	99,500	728,630	11,210	8,000	124-296	23-798	<5.5-400	600	20,000	200,000
Zinc (1-2")	20	329	6,580	62,496	3,125	2,805						

ppm = parts per million
NA = not available
Sample depths 0-1" composite of 5 borings collected December 1992 (IDPH).
Sample depths 1-2" collected March 1992 including two background samples from nearby town (Illinois EPA).
Illinois background values from urban and rural locations (Illinois EPA, 1994).
Health comparison soil guidelines for cadmium and zinc (ATSDR, 1998) and Illinois lead soil standard (IDPH, 1994).

Table 5. Inorganic Concentrations in DePue Sediments (in ppm).

	W. Marquette Storm Grate X202 4-93	**E. Marquette Storm Grate** X203 4-93	**Lagoon** X106 3-92 X201 4-93	**Lagoon-Creek** X108 3-92	**South Ditch** 1 5-94 2 5-94 3 5-94	**Ditch-Lake** X105 3-92	**Lake DePue** X104 3-92	**Lake Turner Background** X103 3-92 NA 4-93
Aluminum	8,220	16,400	12,700 25,000	12,100	NA	281,005	32,100	16,900
Ammonia	NA	NA	NA NA	NA	NA	NA	NA	NA
Antimony	<7.8	<32.7	7.2J <262	ND	NA	ND	NA	6.4J
Arsenic	8.4	8.2	8.7 28.7	19.5	<5 <5 <5	15.3	16.7	8.6
Barium	322	422	70.5 3,780	710	170 82 97	214	244	112
Beryllium	0.85	1.2	0.7 8.5	0.85	NA	ND	1.4	0.87 0.83-0.88
Cadmium	36.4	54.0	ND 1,450	112	81 98 110	275	12.3	0.96 3.4-8.0
Calcium	64,900	55,800	46,600 28600	42,900	NA	15,600	19,700	19,300
Chromium (total)	164	23.6	21.0 <35.4	24.2	4 2 2	49.0	77.9	31.7 34.5-47.7
Cobalt	29	43.4	10.1 170	50.8	NA	51.1	14.0	8.1 9.7-10.1
Copper	35,000	110,000	18.9 217,000	3,400	NA	4,420	73.1	19.7 36.1-46.1
Iron (total)	42,900	14,700	19,700 76,900	32,600	NA	37,100	31,900	19,300
Lead	698	1,160	12.3 4,050	354	160 130 130	128	109	75.6 36.9-55.7
Magnesium	36,800	31,500	25,700 12,000	9,450	NA	9,620	12,000	9,610
Manganese	4,480	2,400	388 8,880	2,020	NA	1,390	677	537 524-621

	W. Marquette Storm Grate X202 4-93	**E. Marquette Storm Grate** X203 4-93	**Lagoon** X106 3-92 X201 4-93	**Lagoon-Creek** X108 3-92	**South Ditch** 1 5-94 2 5-94 3 5-94	**Ditch-Lake** X105 3-92	**Lake DePue** X104 3-92	**Lake Turner Background** X103 3-92 NA 4-93
Mercury	0.13	<0.4	ND <3.2	ND	<0.1 <0.1 <0.1	<0.93	ND	ND <0.17-<0.20
Nickel	61.9	66.5	24.6 150	21.8	NA	67.8	47.8	26.8 34.3-41.2
Potassium	294	<967	3,070 7,740	2,250	NA	5,450	5,450	3,270
Selenium	1.3	2.8	0.56J 14.8	0.84	<10 <10 <10	2.5J	1.6J	0.32 0.48-0.82
Silver	5.5	<4.6	ND <36.9	2.5	NA	2.2	ND	ND <1.0-<1.2
Sodium	420	569	187	889	NA	508	538	245
Vanadium	18.6	2.4	26.9 <38.5	27.9	NA	51.4	57.9	37.8 23.8-28.6
Zinc	30,100	55,100	141 213,000	22,500	NA	64,800	2,170	173 163-370

J = Estimated value
NA = Not analyzed
ND = Not detected
ppm = parts per million

Table 6. Inorganic Concentrations in DePue South Ditch Surface (0-6") Sediments (in ppm) (collected in March 1996).

Sample Numbers	001	003	005	007A	007B	009A	009B	011	013A	013B	014	**Lake Turner** (background) 015, 016,017,018
Arsenic	28.4	26.1	8.4	22.9	19.0	18.2	20.9	15.9	14.4	12.9	8.2	6.9-10.3
Beryllium	<2.3	<2.8	1.9	1.5	1.2	1.3	1.4	1.6	1.2	1.2	0.95	0.83-0.88
Cadmium	273	679	687	845	386	542	602	541	316	367	405	3.4-8.0
Chromium (total)	19.5	<13.9	<6.2	14.2	18.0	13.8	15.8	21.3	21.8	25.7	13.3	34.5-47.7
Cobalt	47.6	66.2	65.1	61.1	40.7	59.4	60.2	50.0	62.3	58.2	31.3	9.7-10.1
Copper	86,200	67,700	82,900	39,900	39,700	41,100	44,500	48,900	22,300	19,400	15,300	36.1-46.1
Lead	1,430	1,090	580	686	650	528	559	522	405	334	234	36.9-55.7
Manganese	1,830	3,080	2,900	2,580	1,530	2,180	2,340	1,670	2,130	2,250	2,000	524-621
Mercury	<1.1	<1.4	<0.62	<0.57	<0.47	<0.51	<0.59	<0.40	0.59	0.46	<0.45	<0.17-<0.20
Nickel	<56.8	<69.4	32.6	51.6	47.2	45.9	46.0	52.1	60.3	57.1	25.2	34.3-41.2
Selenium	<2.3	<2.8	<1.2	<1.1	<0.93	1.0	<1.2	<0.80	2.0	1.8	<0.91	0.48-0.82
Silver	<6.8	<8.3	<3.7	10.1	5.6	8.3	5.4	3.2	1.9	144	<2.7	<1.0-<1.2
Vanadium	16.5	<11.1	12.0	16.2	21.2	12.6	12.8	20.2	19.5	21.0	16.1	23.8-28.6
Zinc	77,800	189,000	105,000	147,000	79,900	157,000	161,000	132,000	113,000	100,000	103,000	163-370

ppm = parts per million

Table 7. Inorganic Concentrations in DePue Surface Waters (in ppm).

	Gypstack S305 3-92 **Clearwater Pond** SW20 3-93 (a) **Gypsum Pond** SW10 3-93 (a)	**Ditch S Lithopone** S104 4-93 S105 4-93 SW2 5-94 SW3 5-94	**Leachate** 6-75	**Lagoon** S304 3-92 SW30 3-93(a)	**Puddle Marquette** IDPH 12-92 S102 4-93 S103 4-93	**Ditch/Lake** S303 3-92 S101 4-93 SW1 5-94	**Lake DePue** S302 3-92	**Background Lake Turner** S301 3-92	**Comparison Value – Child Drinking Water** (in ppm)	**Source**
Aluminum	2.63 1.9 1.7	5.3 0.035 NA	NA	2.49 0.69	NA 10 2.2	0.38 4.6 NA	1.78	0.12	none	
Ammonia	346 NA NA	NA NA 5.9 8.7	NA	54.6 NA	NA NA NA	2.38 NA 7.3	0.618	ND	3	I EMEG
Antimony	ND 0.07 <0.04	<0.34 0.05 NA NA	NA	ND <0.04	NA <3.4 <1.7	ND NA NA	ND	ND	0.004	RMEG
Arsenic	0.368 0.19 0.28	0.0021 0.0022 <0.005 0.006	0.002	0.0194J <0.015	NA <0.0012 <0.0012	ND 0.0031 0.007	0.0023J	0.0026J	0.00002	CREG
Barium	0.056 0.016 <0.005	0.014 0.05 0.03 0.03	0.2	0.026 0.22	NA 0.0056 0.012	0.054B 0.12 <0.1	0.066	0.041	0.7	RMEG
Beryllium	<0.001 <0.005 <0.005	0.0021 0.0014 NA NA	NA	ND <0.005	NA 0.007 0.0027	ND 0.0028 NA	ND	<0.001	0.000008	CREG
Cadmium	0.0385J 0.017 0.031	11.0 <0.0029 0.009 3.1	19.0	0.0569J 0.057	10 12.1 3.8	0.0868 5.6 5.0	0.0131J	ND	0.005	EMEG
Calcium	299 250 310	294 265 190 330	NA	105 52	NA 376 403	127 308 350	110	7.4	none	
Chromium (total)	0.033 0.02 0.03	<0.0046 <0.0046 NA NA	ND	ND <0.01	NA <0.0046 <0.0046	ND <0.0046 NA	ND	ND	0.050	RMEG (VI)
Cobalt	0.044 0.06 0.03	0.11 <0.0049 NA NA	NA	0.253 0.12	NA 10.3 3.9	0.0594 3.2 NA	0.0229	ND	none	

	Gypstack S305 3-92 **Clearwater Pond** SW20 3-93 (a) **Gypsum Pond** SW10 3-93 (a)	**Ditch S Lithopone** S104 4-93 S105 4-93 SW2 5-94 SW3 5-94	**Leachate** 6-75	**Lagoon** S304 3-92 SW30 3-93(a)	**Puddle Marquette** IDPH 12-92 S102 4-93 S103 4-93	**Ditch/Lake** S303 3-92 S101 4-93 SW1 5-94	**Lake DePue** S302 3-92	**Background Lake Turner** S301 3-92	**Comparison Value -- Child Drinking Water** (in ppm)	**Source**
Copper	ND <0.02 <0.02	0.26 <0.0027 0.02 0.02	42.0	0.086 0.23	NA 278 99.3	0.13 84.4 57	0.0368	ND	1.3	MCL
Iron (total)	3.34 1.1 0.79	0.49 4.6 0.19 1.9	14.0	1.72 1.6	NA 0.72 0.13	0.706 14.1 16	1.33	3.45	none	
Lead	ND <0.04 <0.04	0.0035 <0.001 <0.003 0.005	1.0	0.04 0.04	1.5 2.0 1.9	ND 0.45 0.43	ND	ND	0.015	MCL
Magnesium	421 170 330	74.7 122 2.2 140	NA	47.2 27	NA 422 200	55.9 192 240	44.9	31.1	none	
Manganese	4.81 3.7 3.2	19.4 0.49 0.16 7.4	375.0	15.3 7.1	NA 647 247	5.04 201 210	2.18	0.135	0.050	RMEG
Mercury	0.0003 0.0008 0.0005	0.00024 <0.0002 NA NA	ND	0.00006 0.0007	NA <0.0002 <0.0002	0.00005B NA NA	0.00002	0.00009	0.002	MCL
Molybdenum	NA <0.1 <0.1	NA NA NA NA	NA	NA <0.1	NA NA NA	NA NA NA				
Nickel	0.147 0.11 0.11	0.12 <0.15 <0.02 0.05	2.8	0.222 0.1	NA 5.4 2.0	0.0403 1.7 1.9	ND	ND	0.1	MCL
Potassium	87.3 31 64	12.3 5.3 NA NA	NA	9.83 9.6	NA 57.7 38.4	5.19 24.6 NA	5.74	3.74	none	
Selenium	0.018J <0.12 <0.12	0.01 <0.0014 <0.01 <0.005	ND	0.0110J <0.12	NA 0.034 <0.007	0.01J 0.032 <0.025	0.01J	ND	0.020	CEMEG
Silver	ND <0.01 <0.01	<0.0048 <0.0048 NA NA	0.03	ND 0.08J	NA <0.0048 <0.0048	ND <0.0048 NA	ND	ND	0.050	RMEG

	Gypstack S305 3-92 **Clearwater Pond** SW20 3-93 (a) **Gypsum Pond** SW10 3-93 (a)	**Ditch S Lithopone** S104 4-93 S105 4-93 SW2 5-94 SW3 5-94	**Leachate** 6-75	**Lagoon** S304 3-92 SW30 3-93(a)	**Puddle Marquette** IDPH 12-92 S102 4-93 S103 4-93	**Ditch/Lake** S303 3-92 S101 4-93 SW1 5-94	**Lake DePue** S302 3-92	**Background Lake Turner** S301 3-92	**Comparison Value -- Child Drinking Water** (in ppm)	**Source**
Sodium	675 300 550	73.7 138 NA NA	NA	29.8 29	NA 163 93.5	61.7 115 NA	54.1	28.3		
Sulfate	3,480 NA NA	NA NA 350 1,300	NA	650 NA	NA NA NA	342 NA 4,900	222	86	400	P MCL
Sulfide	ND <0.5 <0.5	NA NA <1 <1	NA	ND <0.5	NA NA NA	2.38 NA <1	0.618	ND	none	
Vanadium	0.022 <0.01 <0.01	<0.005 <0.005 NA NA	NA	0.007 0.06	NA <0.005 <0.005	ND <0.005 NA	0.009	ND	0.020	LTHA
Zinc	0.52 8.9 1.4	571 0.78 0.84 190	3,800	62.7 40	448 5,780 2,190	26.5 1,790 1,900	5.31	0.018	3	RMEG

NA = not analyzed ppm = parts per million ND = not detected J = estimated value R = rejected data

(a) sample reanalyzed by U.S. EPA contract laboratory.

Table 8. Inorganic Concentrations in DePue On-site Groundwater (in ppm).

	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7	PS-8	PS-9	PS-10	PS-11	PS-12	PS-13	PS-14	PS-15	PS-16	PS-17	1-96	Comparison Value Child	Source
Ammonia	<0.05	<0.05	14	26	14	0.93	51	1.1	8.5	20	0.24	<0.05	31	35	0.25	1	9	NA	3	IEMEG
Arsenic	<0.005	<0.005	0.05	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	NA	0.003	CEMEG
Barium	0.03	0.02	0.01	0.02	0.01	0.04	0.06	0.04	0.02	0.1	0.04	0.04	0.03	<0.1	<0.01	<0.1	<0.2	NA	0.7	REMEG
Calcium	180	190	600	430	440	210	350	210	320	260	180	170	260	460	490	440	470	NA	NONE	
Cadmium	<0.0005	<0.0005	0.62	3.7	1.1	<0.0005	0.023	0.12	0.024	<0.0005	<0.0005	<0.005	<0.005	24	1.8	48	12	9.44	0.002	CEMEG
Chloride	35	18	15	63	54	16	22	11	9	18	11	<2	28	36	92	17	33	NA	NONE	
Copper	<0.01	0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.2	<0.2	390	216	1.3	MCLG
Fluoride	0.3	0.2	9.5	3.5	4.6	0.7	17	4.8	0.4	0.4	0.3	0.3	0.3	0.2	3.7	0.6	2.3	NA	1.4-2.4	IPDWR*
Iron	0.04	<0.02	<0.02	0.46	1.1	15	2.8	0.05	0.02	16	<0.02	0.05	<0.02	<0.2	<0.2	8.3	1.4	2.08	NONE	
Magnesium	73	84	84	83	120	82	56	70	32	120	68	89	140	240	120	120	550	NA	NONE	
Manganese	0.27	<0.01	18	13	10	0.81	6	0.99	7.8	0.59	0.23	0.01	0.32	170	5.9	73	790	501	0.05	RMEG
Nickel	<0.02	<0.02	0.28	0.34	0.23	<0.02	0.05	0.03	0.1	<0.02	<0.02	<0.02	<0.02	0.2	<0.2	<0.2	7.2	NA	0.1	MCL
Lead	<0.003	<0.003	<0.006	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.006	<0.003	<0.003	0.0613	<0.003	0.43	1.3	0.9	0.015	MCL
Nitrate	5.9	11	54	4.7	21	<0.1	14	18	33	<0.1	<0.1	<0.1	9	16	7.9	1.1	19	NA	10	MCL
Nitrite	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	1	REMEG
Phosphorus	1.4	0.19	3.5	0.88	1.3	0.14	2.9	0.07	0.53	2.7	0.07	0.07	21	0.26	0.34	<0.05	0.18	NA	NONE	
Sulfate	330	400	1,900	2,300	2,800	630	950	490	1,100	700	270	220	650	5,600	1,700	4,600	16,000	NA	500	PMCL
Zinc	<0.02	<0.02	100	160	240	0.74	32	50	42	<0.02	<0.02	<0.02	<0.02	1,900	230	2,400	7,500	4,860	2	LTHA

According to Golder (1995) samples for metals, chloride, sulfate, and sulfide were collected from monitoring wells MW-1 through MW-3 were collected on December 12, 1992, piezometers PS-4 through PS-7 and PS-9 on January 29, 1994. Piezometers PS-1, PS-2, PS-3 and PS-10 on March 9, 1994. Samples for fluoride, ammonia, nitrate, nitrite, sulfate, sulfide, and total phosphorus were collected from piezometers PS-1 through PS-10 on May 6, 1994. Samples for all analyses were collected from PS-11 on May 7, 1994 and from PS-12 through PS-17 on May 18, 1994.

No levels of selenium or sulfide was detected in the above groundwater samples and have not been included.

*Interim Public Drinking Water Regulations.

Table 9. Metal Concentrations in Lake DePue Fish (in ppm). Collected October 1992; fillets analyzed by USFDA.

	Species					Normal Ranges
	Carp	Buffalo	Catfish	Crappie	Bass	ppm
Arsenic (DL=1)	ND	ND	ND	ND	ND	
Cadmium (DL=0.09)	ND	ND	ND	ND	ND	
Chromium (total)	0.11	0.10	0.07	0.07	0.09	0.11-0.23[A]
Lead (DL=0.05)	ND	ND	ND	ND	ND	
Nickel (DL=0.01)	0.12	0.14	ND	0.08	0.07	0.02-0.11[B]
Zinc	25.86	8.95	6.11	6.96	5.94	21.7[C]

[A]Mean concentration in meat and fish (ATSDR Tox. Profile: Chromium)
[B]Range of mean levels in meat, fish, and eggs (ATSDR Tox. Profile: Nickel)
[C]Geometric mean in various whole fish (ATSDR Tox. Profile: Zinc)
DL = detection limit
ND = not detected
ppm = parts per million

Table 10. Summary of 1990 USEPA Toxic Chemical Release Inventory for Zip Codes Near DePue (USEPA, 1993).

	Pounds of Chemicals	
Chemical	On-site	Air Release
Acetone	25,708	
Copper and compounds	1,000-9,999	5
Di(2-ethylhexyl)phthalate	10,000-99,999	
Methanol	10,141	
Methyl ethyl ketone	1,000-9,999	24,041
Toluene	6,285	
Trichloroethylene	1,000-9,999	56,294

No entries were reported for the following communities:

DePue (61322) Tiskilwa (61368)
Bureau (61315) Seatonville (61359)

Table 11. DePue Interior Metal House Dust Concentrations from 15 Residences (in ppm).

Sample Type	Units	Cadmium				Lead				Zinc			
		Range	Median	Mean(a)	Mean(b)	Range	Median	Mean(a)	Mean(b)	Range	Median	Mean(a)	Mean(b)
27 Carpet Samples	ppm (d)	ND (n=10)-128	18	23	19	27-2,760	139	343	250	35-4,100	150	1083	967
	Total μg	ND (n=10)-3,875	44	442	310	7-64,159	838	4,446	2149	130-39,830	3,247	6,598	5,320
	μg/Square Foot	ND (n=10)-1,582	3	92	34	0.1-26,188	41	1,126	162	2-11,951	116	906	481
27 Dust Wipes	μg/Square Foot	ND (n=25)-88	ND	16	13	ND(n=15)-1,428	ND	109	57	34-2,161	318	458	392

ND Not Detectable (Below Detection Limit)
(a) Nondetectable samples calculated as ½ of the Detection Limit
(b) Adjusted mean omitting outlying concentration for comparison only (n=26)
ppm = parts per million

Table 12. DePue Blood Cadmium Screening Summary (in μg/L), September 1993.

Ages	Concentration Range	Mean	ND (n)	% ND of age group
0-2 n=1	<0.5	-	1	100
3-5 n=14	<0.5-<0.5	<0.5	14	100
6-11 n=24	<0.5-1.2	0.33	20	83
12-19 n=5	<0.5-<0.5	<0.5	5	100
20-49 n=26	<0.5-1.10	0.36	22	84
50-69 n=18	<0.5-5.1	0.93	11	61
≥70 n=18	<0.5-3.9	1.16	7	36
Total n=106	<0.5-5.1 ONE ADULT EXCEEDED STANDARD	0.57±0.08	80	75

μg/L = micrograms per liter
Note: Results below the detection limit (DL = 0.5 μg/L) were included as 0.25 μg/L for calculations

Table 13. DePue Random Urine Cadmium Screening Summary, September 1993.

Age	# of Volunteers	Cadmium (μg/L)	Creatinine (mg/L) Normal = 1,000-2,000 (a)	Normalized Value (μg/g creatinine) Action Level = 3.0
0-4	0			
5-9	5	<0.5-<0.5	360-1,370	<0.36-<1.38
10-14	3	<0.5-<0.5	1,120-2,480	<0.2-<0.44
15-18	1	<0.5	2,200	<0.22
19-24	1	<0.5	1240	<0.4
25-29	0	NA	NA	NA
30-39	2	<0.5-<0.5	1,000-1,050	<0.47-<0.5
40-49	3	<0.5-<0.5	670-1,190	<0.42-<0.74
50-59	3	<0.5-0.9	1,070-1,380	<0.36-0.84
60-69	4	<0.5-<0.5	1,130-3,110	<0.16-<0.44
70-79	11	<0.5-4.8	170-3,410	<0.3-3.48
80+	0	NA	NA	NA
Total	33	<0.5-4.8 (28 ND)	170-3,410 (8 LOW; 4 HIGH)	ONE ADULT ABOVE ACTION LEVEL

ND = Not Detected (detection limit is 0.5 μg/L).
μg/L = micrograms per liter
mg/L = milligrams per liter
μg/g = micrograms per gram

Table 14. DePue Blood Lead Screening Summary, September 1993.

Age Range	Lead Concentrations (μg/dL)	Mean (a)	Median	Comparison Values	
				Background(b)	Health Guidelines
0-2 n=2	<0.2-3.8	2.4	2.4	4.1	<10
3-5 n=14	<0.2-9.2	3.6	3.6	3.4	<10
6-11 n=25	<0.2-28.6	4.1	2.8	2.5	<10
12-19 n=5	<0.2-<0.2	1.0	<2.0	1.6	<10
20-49 n=27	<0.2-7.3	2.3	<2.0	2.6	<25
50-69 n=18	<0.2-8.1	3.6	2.8	4.0	<25
≥70 n=18	1.0-12.0	4.7	3.3	4.0	<25
Total n=109	<0.2-28.6	3.4±0.3	2.7	2.8	ONE CHILD EXCEEDED

μg/dL = micrograms per deciliter

(a) Results less than the detection limit of 2.0 μg/dl were designated 1.0 μg/dl for mean calculations.

(b) Blood lead level concentrations from a national survey (Brody, 1994).

Table 15. Organic Contaminants in DePue Environmental Samples (in ppb).

Contaminant	On-site Gypstack X107	On-site Soil X109	Off-site Sediments				Surface Water Lake DePue S302	Soil Comparison Values (Pica child)
			Lagoon X106	Ditch/Creek X108	Ditch/Lake X105	Lake DePue X104		
Acetone	ND	ND	ND	ND	14J	ND	ND	200,000 RMEG
Benzo(a)anthracene	ND	ND	ND	120J	110J	ND	ND	none
Benzo(a)fluoranthene	ND	ND	61J	130J	ND	ND	ND	none
Benzo(b)fluoranthene	ND	ND	170J	320J	190J	ND	ND	none
Benzo(k)fluoranthene	ND	ND	ND	ND	97J	ND	ND	none
Bis(2-ethylhexyl) phthalate	120J	ND	370	120J	750	650	2J	50,000 CREG
Carbon disulfide	ND	ND	ND	ND	10J	ND	ND	200,000 RMEG
Chrysene	ND	ND	100J	170J	150J	130J	ND	none
Fluoranthene	ND	60J	120J	160J	220J	150J	ND	80,000 RMEG
Phenanthrene	ND	52J	50J	190J	100J	67J	ND	none
Pyrene	ND	55J	190J	200J	230J	230J	ND	60,000 RMEG

ppb = parts per billion
ND= Not detected
J=Estimated value

Table 16. DePue Completed Exposure Pathways.

Pathway name	EXPOSURE PATHWAY ELEMENTS								
	Source	Medium	Point of Exposure	Route of Exposure	Receptor Population	Time of Exposure	Exposure Activities	Estimated Number Exposed	Chemicals
Surface Wastes	Gob pile, Ridges, Gypsum stack	Solid wastes, Tailings (fill)	Site wastes, Public and commercial areas	Incidental hand-to-mouth behavior, Ingestion	Workers Trespassers	Past	Contacting wastes, Incidental hand-to-mouth behavior	4,000	Site-related metals
Surface Soil	Surface wastes, Airborne deposition, Surface water, Fertilizers	Surface soils, Soil amendments	Residential yards, House dust Gardens, Local businesses	Ingestion Food	Residents, Gardeners, Consumers	Past Present Future	Contacting soils and dusts, Amending soils	4,000	Site-related metals
			Site properties	Inhalation Ingestion	On-site workers, Trespassers	Past	Contacting soils	3,000	Site-related metals
Sediments	Contaminated soil, Surface water, Surface runoff, Past air deposition	Sediment receiving settling contaminants	Creeks, Lagoons, Standing water	Ingestion	Fishers, Hunters, Waders	Past Present Future	Recreational activity	1,000	Site-related metals
			Lake DePue	Ingestion	Dredging workers	Past	Dredging activities	25	Site-related metals
Ambient air	Process emissions	Fumes, Particulates	Off-site areas, On-site areas	Inhalation Ingestion	Residents, On-site workers	Past	Breathing fume and particulate	4,000	Site-related metals & inorganic chemicals
Indoor air	On-site chemical spill	Fumes	Municipal storm sewer, Residential basements	Inhalation	Residents with basements	Past	On-site spill, Breathing fume in home	1,500	Site-related sulfur-containing compounds

Table 17. DePue Potential Exposure Pathways.

Pathway Name	EXPOSURE PATHWAY ELEMENTS					
	Source	Environmental Media	Point of Exposure	Route of Exposure	Exposed Populations	Time
Groundwater	Gypsum stack	Leachate Groundwater	Contaminated well water	Ingestion	Residents using private wells	Present Future
Surface Water	Surface runoff, Surface wastes, Contaminated soil, Contaminated sediments	Surface runoff and erosion, Permitted discharge	Standing water, Lagoons, South Ditch, Lake DePue, Local creeks, Illinois River	Incidental hand-mouth ingestion, Incidental ingestion while swimming	Trespassers, Waders, Swimmers	Past Present Future
Gardens	Contaminated soil, Contaminated sediments, Contaminated water	Garden vegetables	Private properties	Ingestion	Gardeners, Consumers	Past Present Future
Remediation of surface wastes and soil	Surface wastes Surface soils Airborne deposition Surface water	Soil, Remedial wastes	Residential yards, Area businesses	Inhalation, Ingestion	Residents, Local employees	Future
			On-site remediation	Inhalation, Ingestion	On-site remediation workers	Future
Remediation of sediments	Creek sediments South Ditch Lake sediments	Sediments, Remedial wastes	Areas of re-mediation and recreation	Incidental hand-mouth ingestion	Remediation workers, Recreational individuals	Future
Biota	Surface water runoff, Contaminated soils, Contaminated sediments	Biota	Fish Game animals	Ingestion	Fishermen, Hunters	Past Present Future

Table 18. Comparison of DePue Estimated Residential Soil Exposures to Health Guidelines.

Metals	Soil Ranges[1] mg/kg	Health Guidelines for Ingestion (ATSDR, 1999)		Estimated Ingestion (mg/kg/day)		
		Dose(s) mg/kg/day	Source(s)	Child 16 kg; 200 mg/day 4 days/wk 39 wks/yr 5 yrs	Pica Child 16 kg; 5000 mg/day 4 days/wk 39 wks/yr 5 yrs	Group Exceeding Guidance Level
Arsenic	4.7J-32.4J	0.0003 0.0001-0.0008	Chronic MRL Chronic RfD	0.00002-0.0002	**0.0006-0.004**	Pica Child
Barium	88-8,710	0.07	Chronic RfD	0.0005-0.05	0.01-**1.2**	Pica Child
Beryllium	0.44-0.86	0.002	Chronic RfD	0.000002-0.000005	0.00006-0.0001	None
Cadmium	4.3J-98J	0.0002	Chronic MRL	0.00002-**0.0005**	**0.0006-0.01**	Children
Chromium VI	13.8-38.8	0.003	Chronic RfD	0.00007-0.0002	0.002-0.005	Pica Child
Cobalt	3-10.3	None	None	0.00002-0.00005	0.0004-0.001	Unknown
Copper	15.4J-163J	None	None	0.00008-0.0009	0.002-0.02	Unknown
Lead	38.4-729	None	None	0.0002-0.004	0.005-0.1	Unknown
Magnesium	1,920-24,300	None	None	0.01-0.1	0.3-3	Unknown
Manganese	110-1,180	0.14	Chronic RfD (food)	0.0006-0.006	0.01-**0.16**	Pica Child
Nickel	9.9-21.1	0.02	Chronic RfD	0.00005-0.0001	0.001-0.003	None
Selenium	0.29-1.3	0.005 0.005	Chronic MRL Chronic RfD	0.000002-0.000007	0.00004-0.0002	None
Vanadium	18.6-42.5	0.003	Chronic MRL	0.0001-0.0002	0.002-**0.006**	Pica Child
Zinc	329-6,280	0.3 0.3	Chronic MRL Chronic RfD	0.002-0.03	0.04-**0.8**	Pica Child

[1] Illinois EPA off-site soil concentrations from March 1992 sampling event
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day

FIGURES

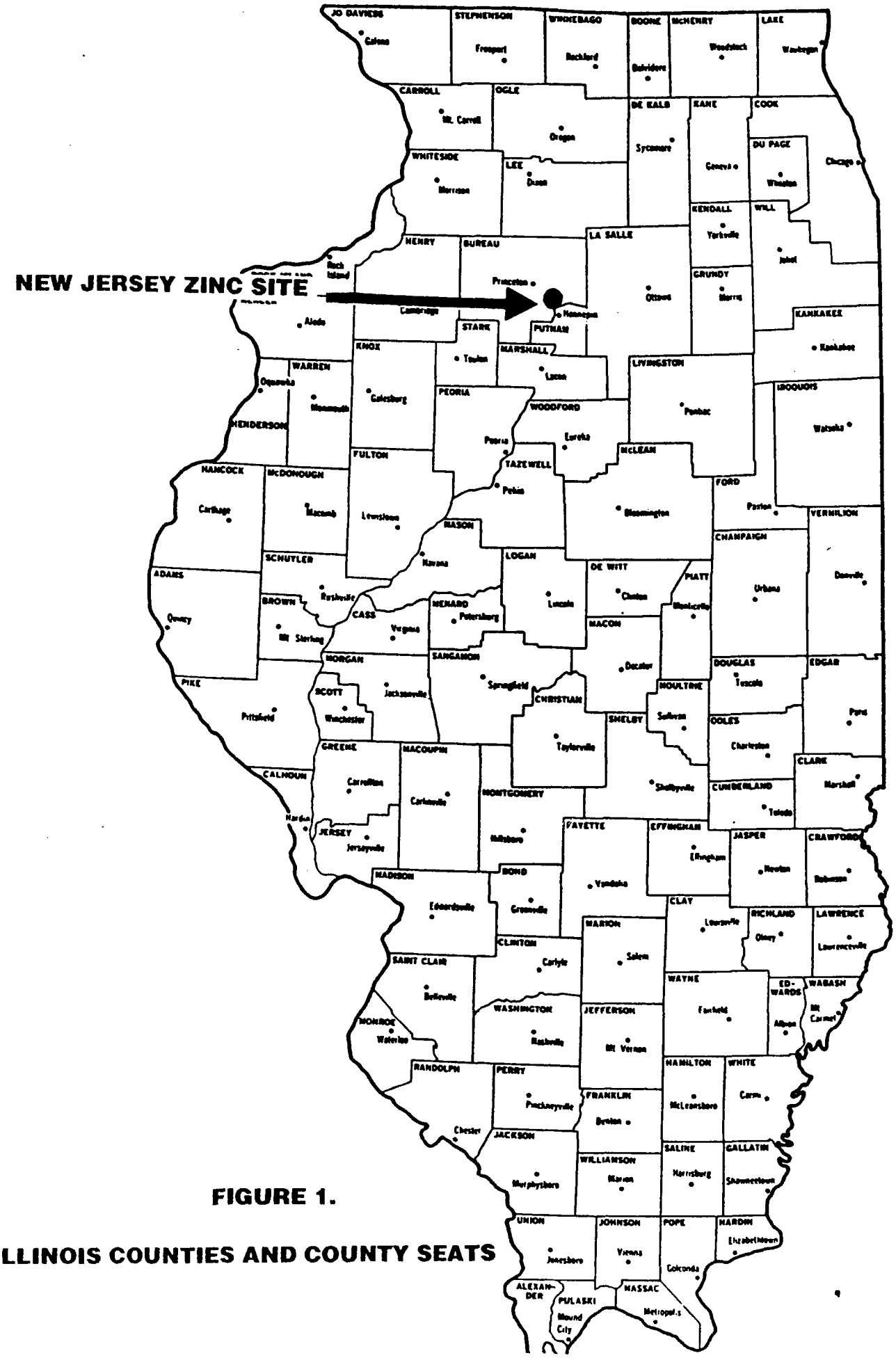


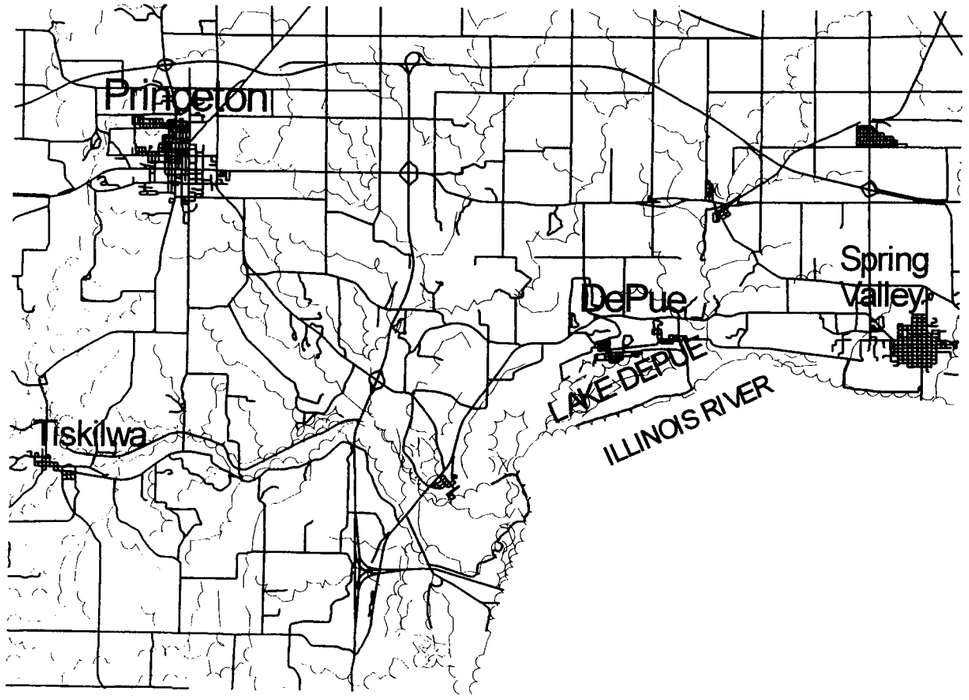
FIGURE 1.

ILLINOIS COUNTIES AND COUNTY SEATS

Source: Illinois Secretary of State (Illinois State Library)

Figure 2

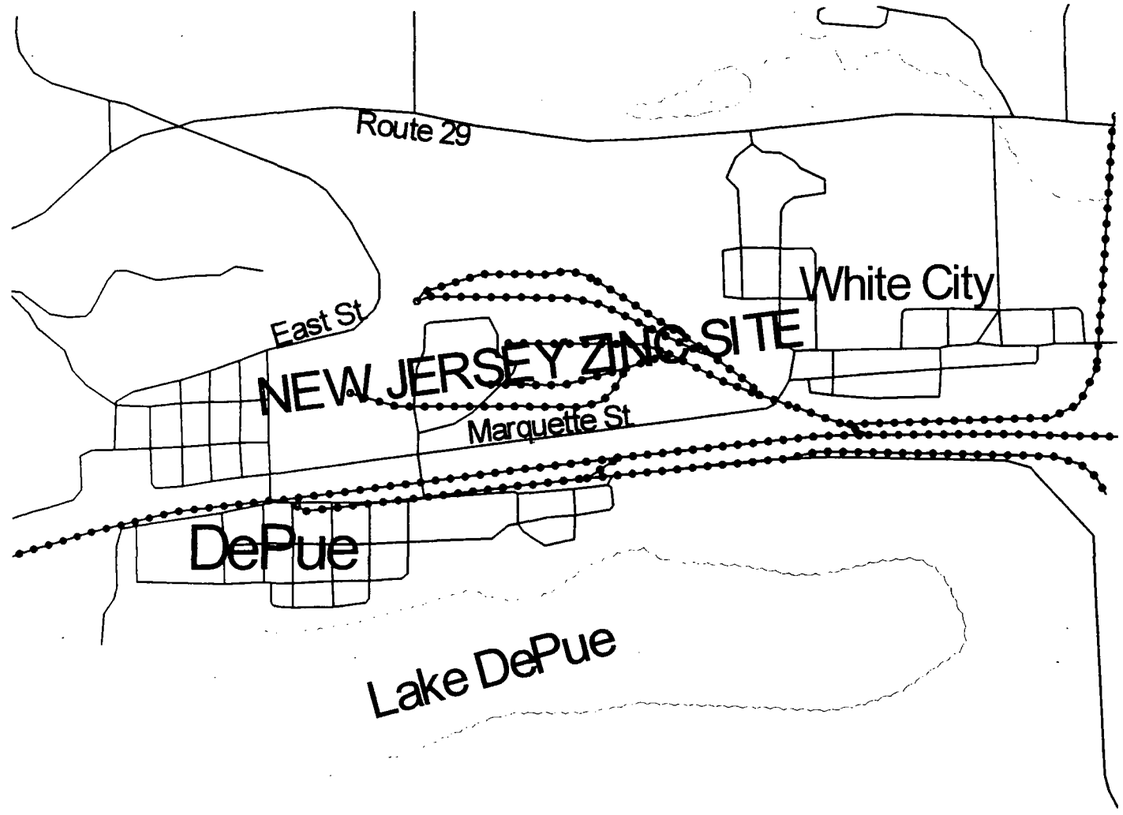
DePue Area
Bureau County



Source: IDPH GIS

Figure 3

Village of DePue



Source: IDPH GIS

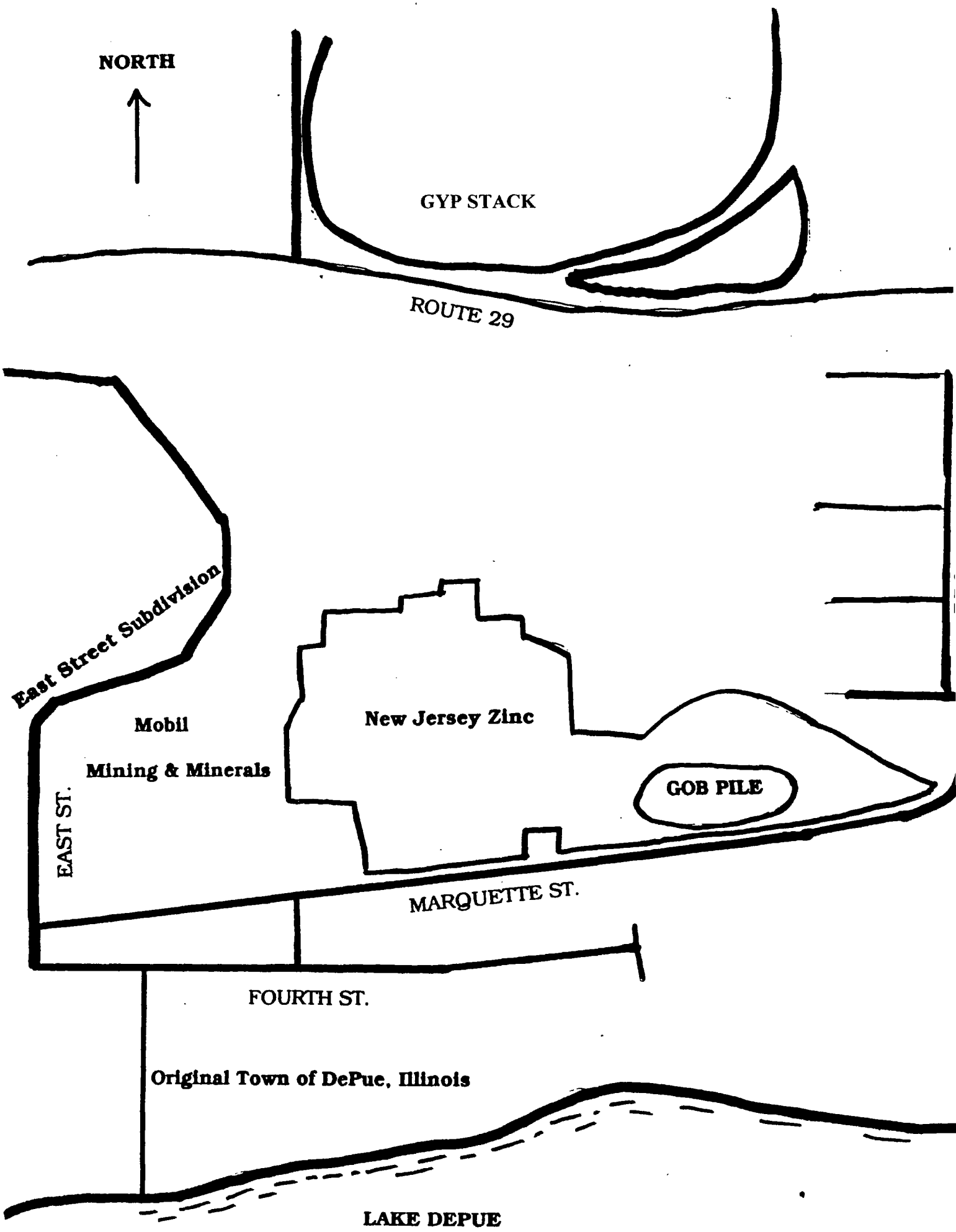


FIGURE 4. New Jersey Zinc/Mobil Mining & Minerals site features

ATTACHMENT

Multiple Sclerosis Case Confirmation and Incidence Rates Associated with a Small North Central Illinois Community

(9 pages)

Multiple Sclerosis Case Confirmation and Incidence Rates Associated with a Small North Central Illinois Community

August 31, 1998

Randolph B. Schiffer, M.D.
Department of Neurology
The University of Rochester Medical Center
601 Elmwood Avenue
Rochester, New York 14642
(716) 275-3301

After November 1, 1998:
Department of Neuropsychiatry
Texas Tech University Health Sciences Center
3601 4th Street
Lubbock, Texas 79430

Background:

In the fall of 1997, the Illinois Department of Public Health (IDPH) asked consultants in the Department of Neurology at the University of Rochester to assist them in an investigation of a possible multiple sclerosis (MS) cluster in DePue, Bureau County, Illinois.

The DePue/New Jersey Zinc/Mobil Mining and Minerals site in Bureau County has been identified by state and national authorities as a potential public health concern because of cumulative exposure to heavy metals deriving from industrial activities at this site since the very first years of this century.

Development of a smelting facility in DePue occurred at the turn of the century in response to market demand for zinc. Zinc ore from northern and western states was imported via railroad or the Illinois River for processing at this facility. Later, secondary smelting occurred using scrap metals which continued into the mid 1980's. A zinc-based pigment was produced here for approximately 20 years. Inorganic byproducts of the smelting, along with imported phosphate ores, and other chemicals were used to produce acids and fertilizers at an adjacent facility for approximately 20 years. Progressively enlarging smelting and gypsum waste piles developed in and about the community through the decades of operation. Waste materials from the smelting operations containing large concentrations of metals including zinc, selenium, nickel, manganese, magnesium, iron, lead, copper, cadmium, barium, arsenic, silver, and vanadium were spread and piled on the ground.

Air exposure to metal emissions were a common event during smelter operations before environmental regulations were promulgated. The emissions served to distribute metals onto nearby residential and public properties. Zinc, cadmium, and barium have been consistently found in large concentrations in residential soils. Compared to background samples collected in a nearby nonindustrialized community, samples collected from yards around the smelter contain 6 to 53 times more zinc, 6 to 144 times more cadmium, and 8 to 84 times more barium. Surface water and sediment samples from the waste site properties and from the nearby lake have also been contaminated by metals and inorganic wastes.

There have been scattered reports of a potential risk factor connection between exposure to certain heavy metals and the development of multiple sclerosis (MS) (Schiffer, et al 1996). Because of these reports, further investigation of the MS cases in Bureau County was begun.

Demographics:

Approximately 1729 people live within one mile of the zinc smelting site, in the town of DePue, Illinois. Demographics concerning the population of DePue, Illinois are included in Appendix I. There is a school in DePue, Illinois that had 400 students in 1992, ranging in age from grades kindergarten through 12.

Methods:

During public meetings and telephone calls from interested parties in 1995, it was brought to IDPH's attention that a number of patients who formerly resided in the community appeared to be suffering from neuroimmunologic disorders. After consultation with the Agency for Toxic Substances and Disease Registry in Atlanta, IDPH proceeded with an investigation. Personal information from nine individuals was collated by a former resident and forwarded to IDPH. Each of these residents had resided in Bureau County during childhood years, at least until age 18. After written informed consent was obtained, medical records were collected and forwarded to the University of Rochester for review and confirmation. These medical records were reviewed for diagnostic validity in accordance with currently accepted diagnostic criteria for research in Multiple Sclerosis (Poser et al 1983).

Statistical Analysis:

The methods used in this study for deriving the expected number of MS cases during the study period and comparing them to the observed number are similar to those used in a previous investigation of an industry-based cluster of MS (Stein et al 1987).

For each case, the date of disease onset was taken to be the date of the first MS symptom. All of the cases had a reported date of symptom onset during the period 1971-1990, therefore this was defined as the study period. Based on the observed number of cases, confidence limits for the underlying true risk of occurrence were determined based on the assumption that the number of events is Poisson distributed, a common assumption for rare events.

There are few well-designed studies of the incidence of MS reported in the literature, and the methods and results of these studies vary. Because of this, the expected number of cases during the study period was computed using three different methods:

Method 1: Application of age-specific incidence rates for Rochester, Minnesota from Percy et al (1971) to the age groups in DePue, Illinois. The age distribution of DePue provided by the 1990 U.S. Bureau of the Census was used, and it was assumed that this age distribution did not vary greatly during the study period. After obtaining the expected number of MS cases per 100,000 population, this number was adjusted to the size of the population of DePue during the period of 1971-1980 (assumed to be 1896, or the average of the population sizes for 1970 and 1980) and during the period of 1981-1990 (assumed to be 1801, or the average of the population sizes for 1980 and 1990). The sum of expected MS cases over these two decades constituted the total expected number of cases for the study period.

Method 2: Application of age-specific incidence rates for the United States from Baum and Rothschild (1981), based on the 1970-1975 NINCDS national survey. These were applied as for

Method 1, but additional adjustments were made for three factors: (1) an increase of 15.4% as a geographic adjustment, because DePue is in a high-incidence latitude where annual incidence is 4.88/100,000 compared with 4.23/100,000 nationally; (2) an increase of 5.7% as a race adjustment, because Baum and Rothschild report a higher rate in whites (4.47/100,000) than in nonwhites; and (3) a decrease of 25% because the NINCDS definition of MS was much broader than ours, including possible MS along with probable MS at a ratio in their reported case series of 1:3.

Method 3: Application of age- and duration-of-observation-specific incidence rates for Denmark from Kurtzke (1978). These were also applied as for Method 1.

If the expected number of cases during the study period falls outside of the 95% confidence interval for the underlying true risk of occurrence, it can be concluded that a significant ($p<0.05$) excess of MS cases occurred during the study period.

Results:

Nine cases of residents of Bureau County, Illinois were identified as having clinically definite MS. Details concerning these cases are presented in Table 1, and brief narrative summaries in Appendix II.

The expected number of cases per year per 100,000 population are computed using the methods of Percy et al and Baum and Rothschild in Tables 2 and 3. By the method of Percy et al, the expected number was 2.8888 (Table 2); by the method of Baum and Rothchild, the expected number was 4.4229 (Table 3). The expected number of cases in a five year period per 100,000 population was 13.8282 (Table 4) according to the method of Kurtzke. These figures were applied to four different five year periods (1971-75, 1976-80, 1981-85, and 1986-90), the first two having an average population size of 1896 and the second two having an average population size of 1801. Summing these over the five-year periods, we obtained the following expected numbers of cases in the DePue population during the study period: 1.07 by the method of Percy et al, 1.50 by the method of Baum and Rothchild, and 1.02 by the method of Kurtzke.

There were nine cases of MS observed during the study period. A 95% confidence interval for the true risk of occurrence is 4.1 to 17.1; a 99% confidence interval is 3.1 to 20.0. The expected risk of MS occurrence was either 1.07, 1.50, or 1.02, depending on which of the three methods was used. Each of these falls outside of the 99% confidence interval. Therefore, we conclude that there was a signficant ($p< 0.01$) excess of MS cases that occurred in DePue, Illinois during the study period.

Discussion:

This report indicates that significantly more residents of the DePue, Illinois area during the

period 1971-1990 developed multiple sclerosis than would have been expected according to available epidemiologic data. The reasons for this incidence cluster are not known. There is a speculative scientific literature which suggests that geographic variations in MS prevalence rates might be related to variable exposures to trace metals. Other competing explanations are available for such clusters, however, including non random assortment of genetic risk factors, exposure to regional virus infections, and selection bias in case finding. Future epidemiologic and scientific studies will be required before definite conclusions can be reached concerning causal factors for this MS cluster.

Bibliography:

Baum HM, Rothchild BB. The incidence and prevalence of reported multiple sclerosis. Ann Neurol 1981; 10:420-428.

Kurtzke JF. The risk of multiple sclerosis in Denmark. Acta Neurol Scand 1978; 57:141-150.

Percy AK, Nobrega FT, Okazaki H, Glattre E, Kurland LT. Multiple sclerosis in Rochester, Minn: a 60 year appraisal. Arch Neurol 1971; 25:105-111.

Poser CM, Paty DW, Scheinberg L, et al. New Diagnostic Criteria for Multiple Sclerosis: Guidelines for Research Protocols. Annals of Neurology 1983;13:227-231.

Schiffer RB, Baggs RB, McDermott MP. Effects of Exposure to Dietary Nickel and Zinc Upon Experimental Allergic Encephalomylitis in SWXJ Mice. J Trace Elements in Exp Medicine 1996;9:1-9.

Stein EC, Schiffer RB, Hall WJ, Young N. Multiple sclerosis and the workplace: report of an industry-based cluster. Neurology 1987; 37:1672-1677.

Table I
DePue, Illinois
Multiple Sclerosis Cluster

Patient #	# of MS Attacks	Clinical Evidence?	MR	CT	Evoked Response	CSF IgG	Dx	First SX	Age at First Symptom	Gender
101	2	yes	positive	not done	positive BAER	not done	CDMS A2	Nov-89	38	F
102	2	yes	not done	atrophy	BAER, VER nl	+OCB's	LSDMS B1	Jun-71	24	F
103	2	yes	positive	not done	Not done	Not done	CDMS A2	1979	17	F
104	2	yes	positive	not done	nl	nl	CDMS A2	1982	25	F
105	2	yes	positive	not done	Not done	+OCB's	LSDMS B1	Mar-82	39	M
106	2	yes	not done	not done	Not done	not done	CDMS A1	about 1984	40	M
107	2	yes	positive	not done	positive, SER's	not done	LSDMS B1	1990	30	M
108	2	yes	positive	not done	VER, BAER neg	+IgG, OCB's	LSDMS B1	Oct-88	38	F
109	2	yes	not done	not done	Not done	not done	CDMS A1	1984	51	F

CDMS A1 = clinically definite multiple sclerosis with two or more attacks plus objective clinical evidence
CDMS A2 = clinically definite multiple sclerosis with two or more attacks plus paraclinical evidence
LSDMS B1 = Laboratory supported definite multiple sclerosis with paraclinical evidence and positive spinal fluid
BAER = Brainstem auditory evoked responses
VER= Visual Evoked Responses
SER= Somatosensory Evoked Responses
OLB= Oligoclonal Bands
F= Female
M= Male

TABLE 2
Age-specific risk for MS in DePue, Illinois: Method 1

Age group	Population* Distribution	One-Year ** Incidence/ 100,000	Expected *** Cases/ 100,000
<10	14.40%	0.0	0.0000
10-19	15.62%	2.0	0.3124
20-29	13.30%	9.1	1.2103
30-39	14.17%	5.9	0.8360
40-49	9.14%	5.0	0.4570
50-59	9.14%	0.8	0.0731
>=60	24.23%	0.0	0.0000
Total	100.00%		2.8888

* From report of the 1990 U.S. Bureau of the Census
** From Table 3 in Percy et al
*** One-year incidence multiplied by population percentage in age group

TABLE 3
Age-specific risk for MS in DePue, Illinois: Method 2

Age group	Population* Distribution	One-Year ** Incidence/ 100,000	Expected *** Cases/ 100,000
<20	30.02%	0.77	0.2312
20-29	13.30%	5.71	0.7594
30-39	14.17%	10.46	1.4822
40-49	9.14%	8.96	0.8189
>= 50	33.37%	3.39	1.1312
Total	100.00%		4.4229
			4.0462 #

* From report of the 1990 U.S. Bureau of the Census
** From Table 1 in Baum and Rothschild
*** One-year incidence multipled by population percentage in age group

# Expected risk adjusted for geography, race, and definition of MS:
4.0462 = 4.4229x 1.154 x 1.057 x 0.75.

TABLE 4
Age-specific risk for MS in DePue, Illinois: Method 3

Age group	Population* Distribution	Five-Year ** Incidence/ 100,000	Expected *** Cases/ 100,000
0-4	7.17%	0.0	0.0000
5-9	7.23%	2.0	0.1446
10-14	8.73%	2.0	0.1746
15-19	6.88%	17.0	1.1696
20-24	6.42%	34.0	2.1828
25-29	6.88%	40.0	2.7520
30-34	6.65%	35.0	2.3275
35-39	7.52%	34.0	2.5568
40-44	5.03%	24.0	1.2072
45-49	4.11%	17.0	0.6987
50-54	4.86%	10.0	0.4860
55-59	4.28%	3.0	0.1284
>=60	24.23%	0.0	0.0000
Total	99.99%		13.8282

* From report of the 1990 U.S. Bureau of the Census
** From Kurtzke
*** Five-year incidence multiplied by population percentage in age group

Population of Bureau County
(Source: U.S. Census Bureau)
APPENDIX I

U.S. Census Bureau Demographics of DePue, Illinois by Decade (Bureau County)													
Year	Total Population	Gender		Race					Age				Households
		Male	Female	W	H	A	B	O	Median	Under 18	<24	>65	
1990	1729	863	866	1523 (88.1%)	589	70 (4.0%)	3 (0.2%)	8 (N)		469 (27.1%)		325 (18.8%)	690
1980	1873	937	936		491		2		32.2	521 (27.8%)		270 (14.4%)	686
1970	1919	946	973	1914			4	1	32.1	33.10%		12.20%	614
1960	1920	932	988	1920							758 (39.5%)	113 (5.9%)	614
1950	2163	1108	1055	1878 (285 (I))							944 (43.6%)	152 (7.0%)	

W= White
H= Hispanic
A= Asian
B= Black
O= Other
N= Native American
I= Foreign Born

Attachment

Public Comments and Responses to Comments

Golder Associates Inc.

4104 -148th Avenue, N.E.
Redmond, WA 98052
Telephone (425) 883-0777
Fax (425) 882-5498

Golder Associates

October 29, 1998

Our ref: 953-8222.5.8

Illinois Department of Public Health
525 - 535 West Jefferson Street
Springfield, IL 62761-0001

ATTENTION: Mr. K. Runkle

RE: PUBLIC HEALTH ASSESSMENT DEPUE/NEW JERSEY ZINC/MOBIL CHEMICAL CORPORATION SITE, DEPUE, BUREAU COUNTY, ILLINOIS

Dear Mr. Runkle:

On behalf of The DePue Group, we are pleased to submit comments on the public comment release dated August 1998, of the above Public Health Assessment (PHA) document. The DePue Group appreciates being afforded the opportunity to review and submit comments on the PHA, and believe that revision of the PHA to reflect our comments will result in a more complete and accurate final document. If you have any questions or require clarification of the comments, please call the undersigned.

Sincerely,

GOLDER ASSOCIATES INC.

Anthony S. Burgess
Senior Consultant

ASB/mb
1029asb2.doc

Enclosure

cc: Dan Burnham, Mobil Oil Corp.
Edmund Chapman, Mobil Bus. Resources Corp.
James F. Frank, Frank & Cowles, Inc.
Jeffrey B. Groy, Esq., Viacom International, Inc.
Henry W. Ipsen, Holme Roberts & Owen
James M. Hanrahan, Horsehead Industries, Inc.
Richard Lange, IEPA
Elizabeth Weaver, Howrey & Simon
Steve Walker, Terra Environmental Svcs.
Thomas W. Unger, Zinc Corp. of America
John R. Knapp, Jr., Zinc Corp. of America
Mark Coldiron, Esq., McKinney & Stringer
Donna Prevedell, Prevedell & Associates

OFFICES IN AUSTRALIA, CANADA, GERMANY, HONG KONG, ITALY, SWEDEN, THE UNITED KINGDOM, THE UNITED STATES

Review of the Public Health Assessment

DePue Site, August 1998

INTRODUCTION

The DePue Group welcomes the opportunity to review and comment on the report of the Public Health Assessment undertaken by Illinois Department of Public Health (IDPH) for the DePue/New Jersey Zinc/Mobil Chemical Corporation Site, DePue, Illinois (the "IDPH Study" or "Public Health Assessment"). The report is based on data collected by the Illinois Environmental Protection Agency (IEPA) and IDPH in 1992-93. Although not included in the report, IDPH and IEPA have also supported additional studies of potential for health effects from the site, specifically investigations undertaken by Dr. R. B. Schiffer from the University of Rochester.

The DePue Group is providing detailed comments on the IDPH Study in Appendix A with a summary presented below and may provide additional comments in the future, as more information becomes available.

SUMMARY OF COMMENTS

1. **IDPH Study does not demonstrate that the site is a public health hazard.** The Public Health Assessment conclusion that "Currently the site can be considered a public health hazard because of the cumulative nature of the heavy metal contaminants that remain in several environmental media throughout the site properties and the community," is not supported by IDPH's own medical evaluation data. By using assumptions that are extremely unlikely to occur, risk assessment modeling can always be made to produce theoretical results indicating a "potential threat." Medical evaluation of DePue residents, members of a stable community that is located appropriately near the DePue site, is the true indication of health status and should replace risk assessment modeling results when available. Accordingly, the DePue Group believes that health data from DePue are the best indication of impact on the community, and that the IDPH study does not indicate there are adverse health effects from the site. Specifically, analysis of blood and urine samples from 110 participants identified no concentrations of lead or cadmium sufficiently high to suggest health issues related to the plant site. IDPH concluded in its Health Outcome Data Evaluation that "the biological screening did not show an immediate public health hazard" and that the results were "probably the same [as] we would find in any community screened." The lack of site-related adverse health data speaks for itself–there is no public health hazard presented by the DePue plant site.

2. **The already favorable Public Health Assessment results can only improve.** The plant was closed down in 1989. Therefore, any potential for ongoing sources due to industrial emissions has been eliminated. Likewise, a number of actions have already been undertaken by the DePue Group to address conditions at the site. Extensive site monitoring by the DePue Group has shown no air exceedances above standards for the site. Additionally, preparation for more remedial activities is underway and further improvement will result. Given that the IDPH Study results are already favorable, the impact of the cessation of operations and ongoing site improvements will only further improve what are already encouraging health-related results for the population of DePue.

3. **The Public Health Assessment was conducted in a confusing and inappropriate scientific manner.** The IDPH Study inappropriately uses a combination of risk assessment techniques and site-specific medical evaluation to conduct the Public Health Assessment and then fails to take into consideration the absence of blood lead and urinary cadmium levels sufficient to cause adverse effects. This results in confusion of real health effects with potential health effects and the value of each. For example, IDPH reportedly found in its risk assessment modeling with respect to cadmium, that based upon extremely unrealistic exposure assumptions, children and adults could experience potential adverse health effects. It is always possible to *calculate* that a theoretical health effect might occur using unrealistic assumptions of exposure that are highly unlikely to occur in nearly all the population. However, the medical evaluation should be the benchmark for establishing the value of risk assessment modeling techniques.

4. **The IDPH study does not make clear the risk assessment methodology and utilizes baseline risk assumptions that are designed to be unrealistic.** Receptors should represent and be associated with an evaluation of the impact of current and not historical conditions. Specifically, it appears that IDPH assesses the potential for health effects via the risk assessment work with two modeled human receptors. The assumptions utilized by IDPH were: (i) a 70-kg worker in areas of highest contamination would ingest 100 mg of soil 5 days a week, 50 weeks a year, for 30 years, and (ii) a 16 kg child would ingest 100 mg of soil, 7 days a week, 52 weeks a year for 10 years. Following IDPH's assumed logic, the worker would be doing remediation activity at the site now and in the future, while the child would be a current resident. The adult worker scenario is completely unrealistic for at least the following reasons:

   - a period of 30-years for the cleanup of the site is far too long, and therefore exposure of a single worker on the same site for 30 years is highly improbable;
   - it seems unlikely that the "highest contamination" portion of the site, although undefined, would still be in place after 30 years; and
   - workers on the plant site would be required under OSHA to wear protective gear and would also receive required training, thus minimizing or eliminating any ingestion.

The child scenario is extreme to the point of being unrealistic for at least the following reasons:

- children typically grow over a ten-year period and do not stay at 16 kg;
- exposure scenarios vary with a child's age and 100 mg of soil ingestion, while very high even for young (e.g., 2 to 3 years) children, is virtually unheard of for children in the 8 to 10 years range unless there is a clear psychological problem such as pica. This represents a medical emergency and should treated as such rather then being included in this risk assessment; and
- weather-related aspects dictate available days for outside playtime, the study does not reduce exposure for weather-related reasons; likewise, the study does not reduce exposure for school attendance or other child activities.

As a result, the health assessment grossly overestimates the potential for adverse health impacts.

5. **The public health assessment contains fundamental misunderstandings of toxicology, exposure-pathways and/or biological effects.** The IDPH Study evaluated a number of metals and inorganic compounds for potential health effects. Most were eliminated from IDPH's evaluation because IDPH does not expect them to cause any adverse health effects. The IDPH's analysis of the remaining constituents (which included arsenic, cadmium, lead, manganese and zinc) was fundamentally flawed as summarized below. The analysis below excludes an assessment of the unrealistic theoretical exposure scenarios discussed in Item #4 above.

Arsenic In discussion of the public health impacts of arsenic the report states that "Arsenic was also present in air emitted from the site during the RI. The levels of arsenic in air are of health concern." While the first statement is true, the second is not. Earlier in the Public Health Assessment it is reported that "air monitoring samples were collected for one year and revealed that current emissions were not violating air standards." Further, the report notes "IEPA concluded that no significant risk currently exists from exposure to metals and airborne particles. Therefore, with the approval of IEPA, the air monitoring program has been discontinued." Thus the conclusion that there is a concern for levels of arsenic in the air is contrary to what the actual site data indicates, and IDPH's conclusion is therefore unsupported.

Cadmium IDPH risk assessment modeling results (using the unrealistic assumptions described above) indicate that a child could potentially receive a dose that might cause a potential health effect. IDPH notes that their scenario is "very conservative" and that the biological monitoring found *no* children with elevated cadmium levels. Notwithstanding this information, IDPH then makes an unsupported statement that "Because of the multiple routes of exposure, ingestion and inhalation, cadmium is of concern." Again, the juxtaposition of

confusing and misleading. If multiple routes actually made an appreciable contribution to unacceptable health conditions, then the medical evaluation should reflect this result which it does not.

Lead The IDPH Study does not reflect current scientific consensus on the relationship between soil lead levels and blood lead, sources of lead exposure in this community, and the lack of elevated blood lead in the population. The conclusion of the IDPH Study that "lead is of concern at the site" "because we do not know what levels of environmental lead can cause *health* effects upon exposure" is inexplicable and without logic.

Manganese and Zinc IDPH's risk assessment modeling calculations show that there could be a potential health concern at the DePue site associated with these two elements. The IDPH Study fails to recognize that manganese and zinc are essential nutrients required for life. It also fails to recognize that there may be different nutrient requirements for different ages and sexes. For example, the RfD for zinc does not even supply the National Academy of Science (NAS) recommended dietary allowance (RDA) for infants, preadolescent children and possibly lactating women (USEPA Integrated Risk Information System, 1998). With regard to manganese, the study uses risk assessment modeling results combined with conjecture as to a *hypothetical* person's diet, and inappropriately concludes that manganese is a concern at the site.

6. **The Public Health Assessment does not consider alternative sources of metals besides the old plant.** Other sources such as the coal-fired power plant located south of DePue could have contributed to contaminants, especially metals, in the surface soil through deposition from air emissions. The DePue wastewater sewage plant may have contributed contaminants to Lake DePue water and sediments. Fertilizers from non-site sources may also have contributed to soil levels of metals. Leaded gasoline and leaded paint are generally known to be major contributors to residential soil. None of these other sources are adequately addressed in the Public Health Assessment.

7. **The Public Health Assessment incorrectly evaluates the level of protection provided by the use of the US EPA RfD.** The IDPH Study makes the errant statement that the RfD may not be protective. To the contrary, the US EPA RfD Background Document (Integrated Risk Information System Reference Dose (RfD): Description and Use in Risk Assessments), states that the standard uncertainty factors used in developing the RfD include the "use of a 10-fold factor when extrapolating from valid experimental results in studies using prolonged exposure to average healthy humans. This factor is intended to account for the variation in sensitivity among members of the human population account for the variation in sensitivity among as well as human effects extrapolated from studies in animals."

8. **The Public Health Assessment report contains numerous factual and interpretive errors.** Some of these are minor and likely arise from IDPH having less familiarity with the Site. However, others are significant and result in erroneous conclusions with regard to potential doses to exposed individuals relative to health guidelines. Details are presented in Appendix A.

9. **IDPH should provide a glossary defining the terms used in the report.** The Public Health Assessment will be read by the general public as well as practitioners in environmental science and toxicology. Many words have a specific meaning in relation to the technical field of use: however, the same words (for example risk, exposure, hazard) have a broader and less precise meaning in general use.

10. **Multiple Sclerosis should be characterized as unrelated to the DePue site.** In the section titled "Community Health Concerns Evaluation," the question of the apparent increased incidence of multiple sclerosis (MS) is raised. Dr. Schiffer of the University of Rochester has now completed his study and discussed his conclusions at a public meeting. He did not conclude that MS is linked to environmental factors originating from the plant site. Dr. Schiffer's conclusions should be included in the Public Health Assessment.

11. **Until the quality of the environmental data used in the risk assessment portion of the public health assessment has been evaluated, any conclusions based on these data are questionable.** The Public Health Assessment uses data from a variety of sources (including IEPA, IDPH, USEPA, Ecology and Environment, Golder Associates, Terra Environmental) to develop the conclusions that the site presents a public health hazard. The quality of the environmental data is variable, reflecting the specific objectives of each investigation, different procedures used by the samplers and laboratories, and the levels of QA/QC employed. For example, the pH value of 1.8 for surface water in the Settling Lagoons (Ecology and Environment 1993) referenced on page 16 of the IDPH study, is probably an error (see discussion in Appendix A). However, that value is in a data set and is therefore available to be referenced, without any qualification. The IDPH study states that environmental data have not been evaluated against data usability criteria. Such evaluation is essential for the conduct of a risk assessment (Final Guidance for Data Usability [sic] in Risk Assessment, USEPA OSWER Directive 9285.7-09A, 1992). Until this is done, any risk assessment conclusions should be qualified by a statement that the data quality is unknown, or the data should be excluded from consideration.

CONCLUSION

The IDPH Study conclusion that "This site is a public health hazard because persons may be exposed to wastes at levels that can result in adverse health effects" is not justified by IDPH's own data. In fact, IDPH's own medical evaluation of the current DePue population, data which reflect both recent and cumulative exposures and lifestyles of those people living in DePue, failed to show adverse health data related to

the DePue plant site. With respect to ongoing potential for health effects at the town site, even utilizing unrealistic assumptions contained in theoretical exposure scenarios, IDPH is able to calculate very few potential health effects. The IDPH Study is confusing in its juxtaposition and apparent interchange of facts with theoretical calculations from the risk assessment. There are a number of fundamental misunderstandings of toxicology, exposure pathways and/or biological effects, and the study does not even mention the potential for other source factors (e.g., lead paint) to be involved at the site.

The IDPH Study should disassociate multiple sclerosis from the plant site based on the investigation and comments from Dr. Schiffer of the University of Rochester.

Finally, the IDPH Study contains numerous factual and interpretive errors and these are reported in our attachment. The study could also benefit from the use of a glossary of scientific terms to enhance its use by the general public.

1028asb1.doc

APPENDIX A

Page	Para	Line	Comment
1	1	1	Revise second and third sentences of paragraph to read "Zinc smelting and production of zinc compounds, and at times sulfuric acid, occurred at this site ~~for nearly 90 years~~ from approximately 1905 to 1989. In addition, acid and fertilizer manufacturing operations took place ~~over several decades~~ from about 1967 to 1987."
1	1	3	Revise fourth sentence of paragraph to read "Currently, the past and present owners of the site . . "
1	2	6	Revise last sentence of paragraph to read "A nearby conservation area where dredge spoils were deposited by the State of Illinois in the early 1980's is under investigation by the Illinois Department of Natural Resources."
1	3	3	Revise third sentence to read "~~Metals in soils may have contributed to chronic problems maintaining groundcover on the site and on adjoining properties~~ Waste materials deposited on the site may have created an unfavorable environment for vegetative growth because of the high summertime temperatures on the black surface and low water holding and cation exchange capacity."
1	3	6	Add the following after the last sentence "Approximately 65 acres of the plant site has been vegetated using mushroom compost. "
2	2	2	Revise second sentence of paragraph to read "Grading and seeding of the large phosphogypsum stacks north of Illinois Route 29 has been accomplished with approximately ~~50~~90 percent ~~groundcover established~~ of the stack surface covered with vegetation or water retained in ponds."
2	2	6	Revise the fifth sentence to read "An interim water treatment facility with ~~tertiary~~ metal removal was built . . ."
2	3	2	Revise the second sentence to read "Currently, the site can be considered a potential public health hazard . . ."
3	2	2	Revise the first sentence to read "The past and present owners ("owners") of the site, collectively known as the "DePue Group", include Horsehead Industries, Mobil Oil Corporation and Viacom International Inc. "

Page	Para	Line	Comment
3	2	4	Starting with third sentence of paragraph, revise to read "Since then the DePue Group and their contractors have increased security and restricted access to the site properties; carried out a dust suppression program; developed a focused remedial investigation of the south ditch leading to Lake DePue; developed and submitted a focused feasibility study for cleanup of the South Ditch; developed and proposed a presumptive remedy consisting of removal of unnatural sediments from the south ditch; developed a heavy metal water treatment system; completed cleanup of a vanadium pentoxide catalyst disposal area; removed and disposed of operations-related sediments from the former settling ponds south of Marquette Street; and ~~have~~ continued with the closure of the "gyp stack" (short for phosphogypsum stack) area and the main operations areas. Air monitoring samples were collected for ~~one year~~14 months and revealed that current emissions were not violating air standards."
3	2	13	Add after the last sentence "The DePue Group is undertaking a clean water diversion program to divert clean runon water away from the site. "
3	3	1	Revise the sentence to read "The Illinois Department of Natural Resources (IDNR) is investigating wastes ~~found~~ deposited by the State on state property in the area."
3	5	9	Revise the eighth sentence to read ". . . market demand for zinc ~~slag~~ and because of ."
4	1	1	Revise the first and second sentences to read "The site in Section 35, township 15 North, Range 10 East of the Fourth Principal Meridian, Bureau County consists of several properties ~~The parent company of (formerly NJ Zinc) is the Zinc corporation of America, which owns acreage site in Section 35, township 15 North, Range 10 East of the Fourth Principal Meridian, Bureau County This 110 acre property~~.and is the former smelting operation in the center of DePue."
4	1	6	Revise the fourth sentence to read "currently the site contains ~~several~~ one large smelting waste ~~piles~~ pile, the largest of which . . ."
4	1	10	Revise the seventh sentence to read "~~Two~~ Several ridges to the north of the gob pile contain some zinc and barium paint pigment wastes . . . "
4	1	16	Delete last sentence and add, "In 1989, the gob pile and two lithopone ridges were covered with 18 inches of soil and seeded."
4	2	2	Revise the second sentence to read "~~Today, much of the fencing has been replaced~~ A chain link fence surrounds the entire plant site, fencing and gates restrain access at the gypstack, and new fencing has been installed around the South Ditch."
4	2	3	Revise the third sentence to read "Site security and monitoring ~~has greatly improved~~ by full-time employees of Mobil and Horsehead Industries was in place at the time of the fencing upgrades, and has been continued by full-time Mobil and interim water treatment plant personnel."

Page	Para	Line	Comment
4	2	5	Revise the fourth and fifth sentence of paragraph to read " ~~A few~~ Three buildings remain on the site. One of them was ~~They have been~~ converted to usable facilities to house the mechanical and monitoring systems for the water treatment plant, which collects surface water and shallow groundwater which flows to the South Ditch, removes metals and ~~discharges the treated water into Lake DePue~~ returns the treated water to the South Ditch."
4	3	5	Revise the fourth sentence to read "The DePue Group has ~~improved the drainage~~ installed a groundwater collection system and raised the sidewalk along Marquette Street in recent years . . ."
4	4	1	Delete the first sentence and insert "Studies conducted by the DePue Group have established that an upward gradient may exist across a buried layer of clay and peat in the southernmost portion of the slag pile area, but the pre-existing presence of springs is speculative, and the occurrence of significant upward flow through the peat layer has not been confirmed."
5	1	4	Revise the second sentence to read "Currently, much of the shallow groundwater from the ~~former smelting area~~ eastern portion of the plant site is being ~~diverted~~ collected and pumped to the water treatment . . ."
5	1	7	Revise the last sentence to read "The clean up of the south ditch is the ~~main~~ objective of a focused RI and feasibility study and a presumptive remedy recently proposed by the DePue Group."
5	2	1	Revise the first and second sentences to read " Adjacent to and both north and west of the old smelting area is the ~~Mobil Mining and Minerals property (owned by Mobil Chemical Corporation)~~ area where phosphate ores and other inorganic chemicals were processed for acid and fertilizer productions. Prior to construction of the fertilizer plant in 1966, the area was used for zinc processing operations."
5	2	4	Revise the third sentence to read " ~~Liquid wastes from this area were collected in two engineered lagoons~~ This plant used Illinois River water for cooling and discharged non-contact cooling water through two cooling ponds located on the north bank of Lake DePue ~~near the ditch used for surface water runoff from the smelting area~~."
5	2	6	Revise the fourth sentence, to read "An incident report was filed with the IEPA Leaking Underground Storage Tank (LUST) program in February 1990 ~~following the discovery of gasoline and diesel fuel leaking from a pipe and spilling onto DePot and Market Streets in DePue~~ when, during removal and closure of three underground storage tanks, petroleum-related soil quality impacts were discovered." Note that the reference to Depot and Market (sic) [Marquette] Streets in the incident report is the facility address. No fuel was spilled onto the land surface at any location. The UST system, including all pipes and dispensers, was located more than 1,400 feet north of Depot and Marquette Streets.

Page	Para	Line	Comment
5	2	11	Beginning at the seventh sentence, revise to read "~~Three~~ Thirteen shallow monitoring wells~~, two downgradient and one upgradient~~ were installed to define the extent of the contamination. The data collected for the LUST regulations and other data collected ~~because of the fuel~~ for the UST area clean up activities have not been included in this assessment."
5	3	1	Revise first sentence of paragraph to read "Mobil owns the gypstack and surrounding land, a large, 150-acre tract . . . "
5	3	2	Revise second sentence of paragraph to read "Gypsum was the main solid byproduct of the fertilizer manufacturing process and was ~~hauled by truck~~ pumped overland to this area."
5	3	3	Delete the second sentence and replace with " An underlying clay barrier was constructed under a portion of the gypstack but limited information is available regarding the extent or thickness of this "liner"."
5	3	4	Revise the fourth sentence to read "During the 1970s local farming interests accepted some gypsum ~~waste~~ presumably to be used as fertilizer."
5	3	6	Beginning with the sixth sentence revise to read "~~Water was channeled to a~~ The gypsum system operates as a closed loop water management system. A permitted outfall (part of the NPDES) leading to an unnamed tributary of a creek southeast of the gypstack receives clean surface water runoff and diverts it around the gypstack."
5	3	8	Starting with the seventh sentence of the paragraph, revise to read "Mobil timely filed an application with the IEPA for renewal of ~~T~~the NPDES permit for the gyp stack area. The permit has since ~~recently~~ expired, but the drainage systems continue to be managed in accordance with the old permit, as required, until the IEPA acts on the renewal application. The closure plans for the gyp stack area has been submitted to the IEPA and ~~are nearing completion~~ the DePue Group is currently working with the IEPA to finalize the plan."
6	2	2	Revise the second sentence to read ". . . in attempts to deepen ~~the channel~~ an oval race track for boat racing."
6	2	3	Revise the third sentence to read ". . . material from the lake bottom was placed by the State on land . . ."
6	3	4	New added paragraph. "A 1992 report published by the Illinois Department of Energy and Natural Resources titled "Erosion and Sedimentation in the Illinois River Basin" reported that as of 1990, Lake DePue had lost 88% of its original capacity and was silting in at the rate of .59 inches per year. This siltation rate is average for Illinois river backwater lakes."
6	3	4	Revise the last sentence to read "Later Mobil ~~developed an~~ improved the effluent control system."

Page	Para	Line	Comment
7	2		The meteorological observations presented in this paragraph are not supported by the existing site-specific meteorological data, which indicates that prevailing wind directions at the DePue Site are similar to regional trends.
7	3	Bullet 1	Revise first sentence to read "Primary zinc smelting using coal as fuel until the early 1940's, and natural gas from the early 1940's until the 1970's."
7	3	Bullet 3	Revise to read "Zinc roast was produced from the smelting operations from about 1905 to the 1940's, and from 1966 to 1971."
7	3	Bullet 4	Add "This plant closed in 1948."
7	3	Bullet 4	Revise first sentence to read "A sulfuric acid plant was developed (from about 1903 through 1906) during primary zinc smelting and operated until the 1940's."
7	3		After bullet 4 insert new bullet "An acid plant was built to serve the fertilizer operation in 1966 and was closed in 1988."
7	3	Bullet 5	Revise first sentence to read "In 1966, a process was developed to manufacture phosphate fertilizer using phosphate ore. The ore ~~which~~ was converted ~~sulfuric acid~~ to phosphoric acid using sulfuric acid."
7	3	Bullet 5	Revise the third sentence to read "Vanadium ~~dioxide~~ pentoxide catalyst was used ~~as a process catalyst~~ in the sulfuric acid manufacturing process."
8	2	3	Delete the last sentence and replace with "Shortly after the spill, Mobil modified the sewer systems on its property to isolate the fertilizer plant drainage systems from the Village's system."
10	2	2	Revise the third sentence to read "Today, five on-site workers consist of ~~the~~ four water treatment plant operators and a Mobil site manager and contractors hired for short term tasks associated with clean-up activities also frequent the site."
10	6	4	Revise the last sentence to read "the wells are reportedly upgradient of the plant site~~; however, no surveys or sampling of these wells have been reviewed for this report~~ and were previously sampled by IEPA."
11	2	4	Revise the fifth sentence to read "~~A~~ Several municipal storm sewer pipes ~~leads~~ discharge into the lake ~~near the ramp~~. The Village of DePue sewage treatment plant also discharges to DePue Lake."
11	3	5	Revise the fourth sentence to read "This is also the area where dredging spoils were deposited by the State (IEPA . . "
12	3	3	Revise the second sentence to read "Residents asked about exposure to the discolored pooled water that previously was present along the sidewalk . . ."
12	4	Item 3	Health assessment comparison values in Table 19 have not utilized carcinogenic endpoints.

Page	Para	Line	Comment
16	5	2	Delete the second sentence. It is apparent from the data reported by E&E, and the description of sampling events, that the reported pH of 1.8 for surface water sample SW-30 collected from the east lagoon was the result of mislabeling or laboratory analysis of the wrong sample. Reportedly, both an unpreserved sample and a sample acidified in the field with nitric acid (for metals analysis) were collected from each sampling location. A field blank also was collected using de-ionized water and the same preservation protocols. A pH of 1.7 (essentially equal to the result of 1.8 for SW-30) was reported for the field blank, which is a highly unlikely result for deionized water unless the sample tested had been preserved with acid. At the time of the sampling, and since 1987 when fertilizer operations were shut down, there were no potential sources of drainage to the lagoons that could have caused such a low pH reading, and routine monitoring of the lagoon discharge from 1990 to 1996 as part of NPDES permit compliance documented that the pH of the lagoon water was never lower than 6.2. These observations strongly suggest that the acidified samples were analyzed for pH, making the pH result for SW-30 unusable. As a general comment, there were numerous quality assurance/quality control problems with the data collected by E&E on behalf of the USEPA in 1993, and a careful review of the usability of the data should be conducted before using it for any purpose.
17	1	2	Revise the second sentence to read "Di(2-ethyl-hexyl)phthalate was also detected in lake surface water (estimated at 2 ppb), and at low concentrations in ~~all site~~ sediments samples collected from the east settling pond, the south ditch, and the lake ~~gyp stack~~." Note that no sediment samples were collected at the gyp stack.
17	1	3	Add the following sentence to the end of the paragraph. "The concentrations reported for acetone and di(2-ethylhexyl)phthalate were very low, and can be artifacts of the laboratory analysis."
17	5	1	Revise the first sentence to read "Four piezometers were installed in the gyp stack area in late 1992 and three more were added in fall of 1993 to monitor groundwater elevations."

Page	Para	Line	Comment
17, 18	7		The list of sources of "known and potential releases of contaminants from on-site properties to off-site properties" should be subdivided into known (i.e., documented) vs. potential, and historical and/or current. For example, the results of fugitive dust monitoring conducted by the DePue Group in 1994 indicated that no significant off-site migration of fugitive dust was occurring at that time. The 1994 monitoring was largely conducted prior to a recent program to vegetate the plant site, and large areas of "bare soil" were present during the monitoring. The data confirm that fugitive dust generation from wind was not a problem in 1994, may not have been a major problem in the past, and the current and future potential has been further reduced with establishment of vegetation over most of the plant site in the last several years. Consequently, fugitive dust migration to off-site areas is a potential historical source, but is not currently operative. It would be helpful if each of the bullets was followed by a brief explanation of the information supporting its inclusion as a potential or known source. The fifth bullet on page 18 regarding the leaking underground storage tanks in 1990 should be deleted because it is known that there were no releases to off-site locations.
19	1	3	Revise the fourth sentence to read "Generally, IEPA scraped away the uppermost layer of soil ~~or residue~~ with a stainless steel scoop before collecting the sample." Note that no residue was encountered at the yard sampling locations.
19	4	1	Revise the first sentence to read "Lake DePue receives general runoff from the area and ~~emissions~~ discharges from . . ."
20	2	3	Delete the third and fourth sentences or list data for Lake DePue and clarify "A field parameter .".
20	2,3	4	Revise the fourth sentence to read "~~IEPA~~The DePue Group installed six air monitoring stations in the fall of 1994 around the perimeter of the site properties to learn if fugitive dust carried any metals."
20	3	1	Delete the second and third sentences. The statement regarding IDPH observations is anecdotal and unsubstantiated by reported data. The content of both sentences implies a condition that has been shown not to exist by the results of a comprehensive air monitoring program.
20	5	1	Revise the first sentence to read "Metals detected at the site ~~are known~~ have been shown to accumulate in plants and animals at other sites or from research."
21	1	3	Revise the fourth sentence to read "Following a lake dredging by the State, ducks were observed to exhibit "rubber neck" behavior, likely due to nervous system disorders." Please provide the reference for the observations and the conclusion that it was caused by nervous system disorders. If the information is unconfirmed, consider deleting the entire sentence.
21	1	5	Revise the fourth sentence to read " . . . .; however, the IDNR investigations of the potential metal enrichment of the state ~~properties~~ designed and managed dredged disposal area is underway".

Page	Para	Line	Comment
21	4		The data used by IDPH for the risk assessment are based on "..information provided in the referenced documents and assumed that adequate quality assurance and quality control measures were followed . . ." There is no indication that these environmental data have been evaluated against data usability criteria. Such evaluation is essential for the conduct of a risk assessment (Final Guidance for Data Usability [sic] in Risk Assessment, USEPA OSWER Directive 9285.7-09A, 1992). Until this is done, conclusions should be qualified by a statement that the data quality is unknown, or the data should be excluded from consideration.
21	6	1	Revise the paragraph to read "The main operations area in town ~~has always contained naturally occurring springs and~~ originally included boggy areas and drained to Lake DePue. ~~that~~ As the site was developed, the site operators engineered some areas of the site to maintain the drainage ~~to drain toward the lake~~. The gyp stack north of town has always had standing water collecting on it in several areas. Settling and evaporation was desired so that the surface water would not run off into adjacent properties. In recent years grading and vegetation in both areas has improved drainage and minimized erosion.
22	2	10	Revise the last sentence to read "The potential for off-site migration of wind-borne contaminated surface soil has been diminished as site owners continue to encourage vegetative growth to prevent erosion and apply irrigation water on the gypstack which maintains wetted vegetative surface."
22	4	2	Revise the second sentence to read "Contaminated wastes and soils from the site are likely the source materials for ~~the contamination residential areas~~ contaminated soils in residential areas."
22	4	3	Revise the third sentence to read "Fugitive dust migration ~~is especially~~ may have been problematic for the large, uncovered, highly contaminated, on-site waste surrounded by residential properties."
22	4	6	The pathway analyses indicate that play areas and gardens may have been amended with organic materials. Such organic materials can contain the same metals that are of potential interest for the site. However, "contamination" from organic materials that are not site-related should be appropriately considered in any evaluation of the residential areas and not attributed to the site.
23	1	4	Insert after the second sentence "All of the workers at the site have received the OSHA 40 hours workers safety training and have access to personal protective equipment, if needed."
23	2		As a general comment, the public health assessment contains a number of unsupported comments about metals-carrying fugitive dust, including references to observed dust. As is reported in the Public Health Assessment, comprehensive fugitive dust monitoring has confirmed that this is not presently a complete pathway. While it may be a potential past and future pathway, references to current inhalation of metals associated with fugitive dust should be removed from the report. The final sentence of the second paragraph on page 23 indicates that IDPH agrees with this finding; consequently, the "present" exposure pathway reference in Table 17 also should be removed.

Page	Para	Line	Comment
23	2	7	Revise the fourth sentence to read "High winds in the past have been observed . . .
23	2	9	Revise the fourth sentence to read "This airborne migration may have been ~~especially~~ problematic for the large uncovered stacks, surrounded by residential properties, prior to the time they were vegetated."
23	4	5	Revise the fourth and fifth sentences to read "Off–site soils in farm fields had ~~site wastes~~ gypsum added to them as fertilizers. ~~No data exists regarding these exposures.~~ ~~It~~ is not known if gypsum addition to farm fields presents any problem, since gypsum from other sources is currently licensed as a soil amendment by the Illinois Department of Agriculture."
23	5	4	The environmental media identified in Table 18 include "Particulate," "Air," and "Biota." It is unclear as to what is meant by the statement that "environmental media are acidic."
24	1	1	Revise the first sentence to read "Former workers~~, current workers, future workers, and trespassers~~ may ~~be~~ have been exposed to surface soil contamination and waste residues on the site ~~primarily from activities involving disturbing, moving, or grading solid waste and contaminated soils~~. Current and future workers are protected by safety training, medical monitoring, and protective equipment.
24	2	2	Revise the first and second sentences to read "It has been reported that clay was installed or was naturally present under at least a portion of the gypstack, ~~which~~ and may inhibit or hinder ~~released~~ release of the waste to groundwater. Limited information is available regarding the extent or thickness of this "liner". ~~Many~~ Reports of seepage from the settling pond adjoining the stack have been documented.~~; however, no evaluation of this clay liner is available."~~
24	2	4	Revise the fourth sentence to read "This is unlikely since this has historically been a swampy area ~~fed by underground springs~~."
24	2	11	Revise the penultimate sentence to read "A ditch on the northern bank of Lake DePue contains unnatural ~~have contamination~~ sediment and water in the ditch discharges ~~into~~ the lake."
24	3	3	Revise the last sentence to read "Presently, ~~this~~ trespass is unlikely . . ."
24	4	1	Revise the first sentence to read "~~Following~~ During the dredging of Lake DePue, the State placed sediments ~~were deposited~~ on the opposite . . . "
25	1	8	The statement that the RfD may not be protective is inaccurate. Per the US EPA RfD Background Document (Integrated Risk Information System Reference Dose (RfD): Description and Use in Risk Assessments), the standard uncertainty factors used in developing the RfD include the "use of a 10-fold factor when extrapolating from valid experimental result in studies using prolonged exposure to average healthy humans. This factor is intended to account for the variation in sensitivity among members of the human population . . ."
25	3	2	It should also be noted that adverse human effects are often extrapolated from studies in animals. Consequently, additional safety factors are used in determining some comparison health guidelines.

Page	Para	Line	Comment
25	3	5	Revise the last sentence to read "At the site, the population potentially exposed . . ."
25	5	7	The metals that were further evaluated and eliminated because their toxic properties and exposure that would not be expected to cause health effects should be listed.
25	6		The exposure parameters indicated in this section of the report do not correspond with the exposure parameters indicated in Table 19. (See additional comments below regarding Table 19).
26	3	1	Arsenic was detected at low concentrations only a few times during the perimeter air monitoring program (note that this was not the RI, which has not yet been undertaken at the site). However, the levels detected were equivalent to the background levels routinely detected by the IEPA in their Total Suspended Particulate air monitoring stations throughout the state. The significance of the arsenic levels detected during the perimeter air monitoring program was described in detail in a July 19, 1996 letter to Mr. Richard Lange of the IEPA (see Appendix O of the Site Assessment Plan, Revision No. 1, August 23, 1996, Terra Environmental Services, Inc.). The IEPA responded in a letter dated August 2, 1996 that the DePue Group's observations regarding arsenic presented in the July 19, 1996 letter were valid (Site Assessment Plan, Appendix O, August 23 1996). Arsenic levels in air at and near the site have been shown to be typical of background air quality in Illinois, and as such, should not be considered a site-related condition. Note also that page 3 of the Public Health Assessment indicates that during the RI "air monitoring samples were collected for one year and revealed that current emissions were not violating air standards." The first two sentences of the paragraph should therefore be deleted, as they are incorrect.
26	4		Calculated exposures indicate that a child could receive a dose that would be a health concern. The authors note the scenario is conservative and the exposure investigation found no children with elevated cadmium blood or urine levels. However, an unsupported statement is then made that "Because of the multiple routes of exposure, ingestion and inhalation, cadmium is of concern." If multiple routes contributed to unacceptable exposures, then the biological monitoring would reflect the additivity of those multiple exposures. Since the monitoring did not indicate unacceptable blood or urine cadmium levels, the statement that cadmium is of concern is inappropriate, and the last sentence of the paragraph should be deleted.
26-28			The text is not consistent in presenting information on the individual contaminants of interest. The maximum concentrations in soil are provided for some and not for others. The presentation of material should be consistent.
27	1		The results of perimeter air monitoring indicated that lead levels in air near the DePue Site are not presently a health concern. Consequently, references to an inhalation pathway for lead in air from the site should be deleted.

Page	Para	Line	Comment
27	1	1	The first sentence of the discussion on lead should be deleted because it is misleading. An increase in blood lead levels is dependent on more than just lead concentration in soil. It is also dependent on the form of lead and its bioavailability, the exposure conditions, the nutritional status of the individual, other sources of lead, etc. The reality check for DePue should once again be the biological monitoring that was conducted. Only one child had an elevated blood lead level. Investigation suggested that lead dust from old paint may have contributed to the blood lead level.
27	2	6	To conclude that "Because we do not know what levels of environmental lead can cause health effects upon exposure, lead is of concern at the site." is also not justified. There are sufficient data from a number of other sites around the country and toxicological data from human and animal investigations that can be used to put the soil concentrations detected at DePue into perspective with respect to health effects. There may be uncertainty in understanding the contribution of soil lead to blood lead levels, however, the biological monitoring of a susceptible population (i.e., DePue children) supports the conclusion that blood lead levels in children do not exceed currently recommended guidelines that are considered to be protective of health impacts. Based on our current understanding of health impacts from lead, there do not appear to be unacceptable exposures from environmental media from the site.
27	4	3	The conclusion that manganese is a concern at the site is based on a hypothetical justification "If someone ate a diet that contains more than normal amounts of manganese and receives the doses possible from exposure to manganese at the site and in yards, that exposure should be further evaluated. For that reason, manganese is a concern at the site." The conclusion "For that reason . . ." should be deleted. It is correct to state that further evaluation may be important for certain populations, however, those populations should be more clearly defined.
28	1		The conclusion that zinc is a concern at the site is not based on sound justification. According to Table 19, the zinc health guideline (an RfD of 0.3 mg/kg-d) is exceeded only for the pica child (both maximum concentrations detected) and for the child consuming 200 mg/d of soil contaminated at the highest IDPH detected zinc concentration. Zinc is an essential nutrient. The RfD for zinc does not supply the recommended daily allowance for infants, preadolescent children or, possibly lactating women (USEPA Integrated Risk Information System, 1998). Therefore, the populations that are most likely to incidentally ingest soil (children) actually have a higher need for zinc than the health guideline used in the evaluation. Furthermore, the RfD is based on soluble forms of zinc. Zinc in a soil media is likely to have less bioavailability. This type of analysis should be considered before indicating zinc is a concern for the site.

Page	Para	Line	Comment
29	2	5	"It did appear that the older participants had more frequent detections than the younger residents. This may suggest increased body burdens of cumulative metals in some individuals." Based on our understanding of cumulative metals such as cadmium, it is expected that older individuals would have higher body burdens as they have had lifelong exposures from multiple sources (food, smoking, air emissions, work exposures, recreation exposures such as stained glass making, etc.). This is not an unusual finding and the text should indicate so.
30	5	1	Revise the first sentence of the Conclusions paragraph to read "Based on the information reviewed, the site ~~is~~ has the potential to be a public health hazard . . . " The conclusion that "This site is a public health hazard because persons may be exposed to wastes . . . at levels that can result in adverse health effects" is not justified by the available data. Exposures can be calculated that predict exposures at levels greater than health guidelines. However, the biological monitoring data (e.g., cadmium and lead) do not confirm that unacceptable exposures have occurred. This is an example of the confusion that calculated estimates of exposure (which are conservative estimates) that exceed health guidelines equate to actual health effects. USEPA has addressed this issue in their discussion of the RfD (US EPA RfD Background Document (Integrated Risk Information System Reference Dose (RfD): Description and Use in Risk Assessments). "In practice, the acceptable daily intake (ADI) is viewed by many (including risk managers) as an "acceptable" level of exposure, and, by inference, any exposure greater than the ADI is seen as unacceptable." This strict demarcation between what is "acceptable" and what is "unacceptable" is contrary to the views of most toxicologists, who typically interpret the ADI as a relatively crude estimate of a level of chronic exposure which is not likely to result in adverse effects to humans. The ADI is generally viewed by risk assessors as a "soft" estimate, whose bounds of uncertainty span an order of magnitude. That is, within reasonable limits, while exposures somewhat higher than the ADI are associated with increased probability of adverse effects, that probability is not certainty."

Page	Para	Line	Comment
30	5	12	The conclusion that there is a public health hazard is not supported by the data. Although it is acknowledged that there is not an immediate health concern, two statements are incorrectly made that suggest long term effects are still likely. "Because of the cumulative nature of cadmium and lead, former workers and longtime neighbors may have excessive body burdens and continued exposures may result in adverse health effects. . . . "Screening did not show an immediate health concern; however the cumulative nature of cadmium and lead present a public health hazard due to the presence of metals in contaminated environmental media." ATSDR has concluded that urinary cadmium levels primarily reflect total body burden (with some more limited contribution from recent exposures) and blood cadmium levels reflect recent exposure (Agency for Toxic Substances Disease Registry, Toxicological Profile for Cadmium [draft], October, 1991). Thus, one would expect to find elevated urinary cadmium if the population was exposed to increased levels of cadmium in their environment. The lack of unacceptable levels of cadmium found in urine and blood samples from the resident population does not support the conclusion that an exposure of concern has occurred. These statements also ignore the fact that the site has been operated for several decades so accumulation of lead and cadmium, if it had occurred would be reflected in recent biological monitoring. This monitoring did not indicate increased cadmium or lead levels in the individuals monitored. In addition, the statements also ignore that any future exposures that occur are likely to be much less than any that may have occurred in the past because of remediation efforts that have taken place or are planned.
31	3	6	Revise the fourth sentence to read "They are shorter than adults, resulting in the potential for them to ~~which means they~~ breathe dust~~,~~ and soil ~~heavy vapors~~ close to the ground." Note that no volatile organic compounds (which would generate heavy vapors) have been identified as a concern at the site.
31	4	2	Revise the second sentence to read "Historically, children, who are now adults, were likely exposed . . ."
61	Table 16		The source of the Air Health guidelines are not provided for this table.
61	Table 16		The highest concentration detected should be explained. Is this the highest 24 hr concentration of inorganic in air? Or is it the highest long term or annual average detected in air? The concentration detected must be comparable to the health limit that is being used to evaluate it. A sufficient explanation of the numbers has not been provided so that the reader can evaluate the information presented.

Page	Para	Line	Comment
62	Table 17		Pathway Sediments, Point of Exposure, Lake DePue, exposure activity - should be revised. The dredging workers will not have "recreational activity" as their exposure activity.
63	Table 18		Pathway Surface water (second row), Point of Exposure and Route of Exposure: It is unlikely that waders and swimmers will ingest standing water or storm sewer water.
64	Table 18		Pathway Indoor air. This potential pathway should be labeled as "Past." "Future" should be deleted since there are no data to support the presence of volatiles migrating in soil gas.
65, 66	Table 19		We conducted a calculation check for estimated ingestion doses in Table 19 and the data are presented in Attachment 1.
65, 66	Table 19		The receptors and exposure parameters indicated in the table that are used to develop the range of estimated ingestion doses do not agree with the text provided on page 25 of the report. According to page 25 of the report, exposure scenarios were developed for soil ingestion by on-site workers and by children playing in contaminated yards. It was assumed that a 70-kilogram worker in areas of highest contamination would ingest 100 milligrams of soil, 5 days a week, 50 weeks a year. for 30 years. For residential exposures, it was assumed that a 16-kilogram child would ingest 100 milligrams of soil, 7 days a week, 52 weeks a year, for 10 years. The table provides two child exposures, one with an ingestion rate of 5000 mg/day for the Pica Child and one with an ingestion rate of 200 mg/day. The text and tables should be consistent.

ATTACHMENT 1

Pages 65 and 66, Table 19: We conducted a calculation check for estimated ingestion doses in Table 19 using updated MRLs (the only MRL was cadmium and it has changed) and updated RfDs. In addition, provisional RfDs (RfDs that USEPA has developed but that have not been published in IRIS or the Health Effects Assessment Summary Tables) were added to the table if there was no other available health guideline. Our initial calculation check used the exposure parameters indicated in Table 19. All the ingestion doses calculated for a 70 kg adult ingesting 100 mg/day soil and some of the doses calculated for a 10 kg child ingesting 5000 mg of soil per day (aluminum and chromium VI) and 200 mg of soil per day (arsenic) were different from those provided in Table 19 of the original report. The results of the calculation check are provided in Table 1 accompanying these comments. Ingestion doses that are different from those provided in Table 19 of the report are provided in bold in Table 1.

The formulas used to calculate the estimated ingestion doses as part of our calculation check are:

$Intake_{child}$ (mg/kg/day) = C x IR x CF/BW
$Intake_{child}$ (mg/kg/day) = (C mg/kg x 200 mg/d x 1E-06 kg/mg) / (10 kg)
$Intake_{child\ pica}$ (mg/kg/day) = (C mg/kg x5000 mg/d x 1E-06 kg/mg) / (10 kg)

$Intake_{adult}$ (mg/kg/day) = C x IR x CF / BW
$Intake_{adult}$ (mg/kg/day) = (C mg/kg x 100 mg/d x 1E-06) / (70 kg)

where:
C = concentration in soil
IR = ingestion rate
CF = conversion factor
BW = body weight

A second table was prepared using the exposure parameters that were provided on page 25 of the text. The exposure parameters listed on page 25 assumed that a 70-kilogram worker in areas of highest contamination would ingest 100 milligrams of soil, 5 days a week, 50 weeks a year. for 30 years. For residential exposures, it was assumed that a 16-kilogram child would ingest 100 milligrams of soil, 7 days a week, 52 weeks a year, for 10 years. Table 2 provides a comparison of Table 19 original estimated ingestion doses with a corrected range of estimated ingestion doses using the exposure parameters indicated in the text. The formulas used in the corrected calculations using the new exposure parameters are:

Intake mg/kg-day = (C x IR x EF x ED x CF) / (BW x AT)

$Intake_{child}$ (mg/kg/day) = (C mg/kg x 100 mg/d x 365 d/yr x 10yr x IE-06 kg/mg) / (16 kg x 365 d/yr x 10 yr)

$Intake_{adult}$ (mg/kg/day) = (C mg/kg x 100 mg/d x 250 d/yr x 30yr x 1E-06 kg/mg) / (70 kg x 365 d/yr x 30 yr)

where:
C = concentration in soil
IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor
BW = body weight
AT = averaging time

Based on the exposure parameters indicated in the text, cadmium (child and adult) and zinc (child) are the only two metals that have an estimated ingestion dose that exceed a health guideline. There is no MRL or RfD health guideline for lead.

Calculation Check of Table 19 Using Updated Oral RfD and Exposure Parameters Indicated in Table 19

	Soil Values mg/kg	Health Guideline Ingestion			Range of Estimated Ingestion Dose mg/kg/day			
		Dose (Chronic Oral MRL mg/kg/day	Oral RfD (mg/kg/day)	SOURCE	PICA CHILD (10 kg; 5000 mg/day)	CHILD (10 kg; 200 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP
Aluminum	20,100	None	1	EPA-NCEA provisional value; 1992a	**10.05**	0.4	**0.03**	YES/PICA CHILD
Arsenic	4.7J-32.4J	None	0.0003	IRIS, 1998	0.0024-0.016	**0.000094 -0.00065**	**0.0000067 -0.000046**	YES/CHILD
Barium	8710	None	0.07	IRIS, 1998	4.36	0.17	**0.012**	YES/CHILD
Beryllium	0.86	None	0.002	IRIS, 1998	0.0004	0.000017	**0.0000012**	NONE
Cadmium	98J[1] 9100[2]	0.0002	0.001	IRIS, 1998	0.049 - 4.6	0.00196 - 0.18	**0.00014 - 0.013**	ALL
Chromium (as Chromium VI)	38.8	None	0.003	IRIS, 1998	**0.0194**	0.0008	**0.000055**	YES/PICA CHILD
Cobalt	10.3	None	0.06	EPA-NCEA provisional value; 1992b	0.0052	0.0002	**0.000015**	NONE
Copper	163J	None	0.04	EPA-NCEA provisional value; 1991	0.08	0.033	**0.00023**	YES/PICA CHILD
Lead	729[1] 7355[2]	None	400 mg/kg	EPA; 1994	0.36 - 3.7	0.015 - 0.15	**0.001 - 0.01**	UNKNOWN
Magnesium	24300	None	None	None	12.2	0.49	**0.035**	UNKNOWN
Manganese	1180	None	0.02	IRIS, 1998	0.59	0.02	**0.0017**	YES/PICA CHILD
Nickel (as soluble salts)	21.1	None	0.02	IRIS, 1998	0.011	0.0004	**0.00003**	NONE
Potassium	3880	None	None	None	1.9	0.08	**0.006**	UNKNOWN
Selenium (and compounds)	1.3	None	0.005	IRIS, 1998	0.00065	0.000026	**0.000002**	NONE

Golder Associates

Calculation Check of Table 19 Using Updated Oral RfD and Exposure Parameters Indicated in Table 19

	Soil Values mg/kg	Health Guideline Ingestion			Range of Estimated Ingestion Dose mg/kg/day			
		Dose (Chronic Oral MRL mg/kg/day	Oral RfD (mg/kg/day)	SOURCE	PICA CHILD (10 kg; 5000 mg/day)	CHILD (10 kg; 200 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP
Vanadium	42.5	None	0.007	HEAST, 1997	0.021	0.00085	**0.00006**	YES/PICA CHILD
Zinc	6030[1] 99500[2]	None	0.3	IRIS, 1998	3.0 - 49.8	0.12 - 2.0	**0.009 - 0.14**	YES/CHILD
[1] Calculated using highest IEPA off-site soil concentration for this metal								
[2] Calculated using highest IDPH off-site soil concentration for this metal								
Ingestion doses that are different from those provided in Table 19 of the report are in bold								
EPA 1991:Memo re: "Interim Oral RfD for Copper" from the Superfund Health Risk Technology Support Center to U.S. EPA Region X.								
EPA 1992a:Memo re: "Toxicity and carcinogenicity of aluminum" from the Superfund Health Risk Support Center to U.S. EPA Region X.								
EPA 1992b: Memo re: "Oral Toxicity Assessment for Cobalt" from the Superfund Health Risk Support Center to U.S. EPA Region X.								
EPA 1994: Memo re: "Revised interim soil lead guidance for CERCLA sites and RCRA corrective action facilities" from the OSWER.								
HEAST, 1997: Health Effects Assessment Summary Table. U.S. EPA.								
IRIS, 1998: Integrated Risk Information System. U.S EPA.								

Calculation Check of Table 19 Using Updated Oral RfDs and Exposure Parameters Indicated on Page 25 of the Report

	Health Guideline Ingestion		Original Range of Estimated Ingestion Dose mg/kg/day				Corrected Range of Estimated Ingestion Dose mg/kg/day Based on Exposure Parameters Provided on p.25 of the Report		
	Oral RfD (mg/kg/day)	SOURCE	PICA CHILD (10 kg; 5000 mg/day)	CHILD (10 kg; 200 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP	CHILD (16 kg; 100 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP
Aluminum	1	EPA-NCEA provisional value, 1992a	1	0.4	0.012	UNKNOWN	0.126	0.0197	NO
Arsenic	0.0003	IRIS, 1998	0.0024-0.016	0.00019 - 0.00065	0.000003 - 0.000019	YES/CHILDREN	0.000029-0.0002	0.0000046-0.000032	NO
Barium	0.07	IRIS, 1998	4.36	0.17	0.005	YES/CHILDREN	0.054	0.0085	NO
Beryllium	0.002	IRIS, 1998	0.0004	0.000017	0.0000005	NO	5.38E-06	0.00000084	NO
Cadmium	0.001 0.0002	IRIS, 1998 MRL (ATSDR)	0.049 - 4.6	0.00196 - 0.18	0.000059 - 0.0055	YES/ALL	0.0006-0.057	0.000096-0.0089	YES/CHILD & ADULT
Chromium (as Chromium VI)	0.003	IRIS, 1998	0.19	0.0008	0.000023	YES/PICA CHILD	0.00024	0.000038	NO
Cobalt	0.06	EPA-NCEA provisional value; 1992b	0.0052	0.0002	0.000006	UNKNOWN	0.000064	0.00001	NO
Copper	0.04	EPA-NCEA provisional value; 1991	0.08	0.003	0.000098	UNKNOWN	0.001	0.00016	NO
Lead	400 mg/kg	EPA; 1994	0.36 - 3.7	0.015 - 0.15	.00044 - 0.0044	UNKNOWN	0.0046-0.046	0.0007-0.0072	UNKNOWN
Magnesium	None	None	12.2	0.49	0.15	UNKNOWN	0.15	0.024	UNKNOWN
Manganese	0.02	IRIS, 1998	0.59	0.024	0.00071	YES/CHILDREN	0.0074	0.0012	NO

Calculation Check of Table 19 Using Updated Oral RfDs and Exposure Parameters Indicated on Page 25 of the Report

	Health Guideline Ingestion		Original Range of Estimated Ingestion Dose mg/kg/day				Corrected Range of Estimated Ingestion Dose mg/kg/day Based on Exposure Parameters Provided on p.25 of the Report		
	Oral RfD (mg/kg/day)	SOURCE	PICA CHILD (10 kg; 5000 mg/day)	CHILD (10 kg; 200 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP	CHILD (16 kg; 100 mg/day)	ADULT (70 kg; 100 mg/day)	EXCEEDED/GROUP
Nickel (as soluble salts)	0.02	IRIS, 1998	0.011	0.0004	0.000013	NONE	0.0001	0.00002	NO
Potassium	None	None	1.9	0.08	0.002	UNKNOWN	0.0243	0.0038	UNKNOWN
Selenium (and compounds)	0.005	IRIS, 1998	0.00065	0.000026	0.0000008	NONE	0.0000081	0.00000127	NO
Vanadium	0.007	HEAST	0.02	0.00085	0.00026	UNKNOWN	0.00027	0.000042	NO
Zinc	0.3	IRIS, 1998	3.0 - 49.8	0.12 - 2.0	0.0036 - 0.06	UNKNOWN	0.0377-0.62	0.0059-0.097	YES/CHILD
[1] Calculated using highest IEPA off-site soil concentration for this metal									
[2] Calculated using highest IDPH off-site soil concentration for this metal									
EPA 1991:Memo re: "Interim Oral RfD for Copper" from the Superfund Health Risk Technology Support Center to U.S. EPA Region X.									
EPA 1992a:Memo re: "Toxicity and carcinogenicity of aluminum" from the Superfund Health Risk Support Center to U.S. EPA Region X.									
EPA 1992b: Memo re: "Oral Toxicity Assessment for Cobalt" from the Superfund Health Risk Support Center to U.S. EPA Region X.									
EPA 1994: Memo re: "Revised interim soil lead guidance for CERCLA sites and RCRA corrective action facilities" from the OSWER.									
HEAST, 1997: Health Effects Assessment Summary Table. U.S. EPA.									
IRIS, 1998: Integrated Risk Information System. U.S EPA.									

The Illinois Department of Public Health (IDPH) responses to the "Summary of Comments" in the comment package received in October 1998 as follows, numbered according to the original statements.

1. The statement in the public health assessment (PHA) that "the site is a public health hazard" is the appropriate conclusion category. IDPH selected that category using ATSDR criteria and guidance.

   IDPH screened volunteers in DePue in 1993 because the Illinois Environmental Protection Agency (IEPA) asked for our department's opinion regarding an immediate clean up. The results of the biological screening indicated that this site should not be considered an "urgent public health hazard," and IDPH did not recommend an immediate clean up. IDPH did not conduct a "medical evaluation" of the community, nor did we conduct a case-controlled "study." IDPH was able to screen volunteers for two metals (lead and cadmium) quickly and with very limited funds. Only venous blood samples and random urine samples were collected and analyzed. Blood samples reflect only recent lead and cadmium exposure. Although cadmium in urine can reflect accumulated body burden, levels respond to recent exposure. Levels rise sharply when the critical level for renal damage is reached.

   The PHA is not a quantitative risk assessment as developed by USEPA, nor is the PHA process considered "risk assessment modeling." The objective of the PHA is to evaluate current, past, and possible future exposures and to provide information on health implications of those exposures.

2. IDPH agrees that the efforts made by the DePue Group with IEPA oversight has served to improve exposure conditions. Additional statements about improved conditions have been added to the PHA. When IDPH is informed of successful mitigating activities and is given data packages, we are able to consider the impact activities have on reducing exposures and can issue statements reflecting that impact.

3. Please refer to answer #1. IDPH again emphasizes that the cadmium screening, as with blood lead screening, was done to answer the question as to whether immediate action was needed to stop exposure. The screening was not population comprehensive and cannot be used to indicate levels of past exposure or the potential for future exposure.

4. Again, IDPH agrees that the selected exposure conditions are conservative. When evaluating conditions that can impact human health, especially the health and well being of children, IDPH and ATSDR feel that the evaluation must be conservative. IDPH also agrees that current conditions, clean up efforts, and the considered worker protection activities serve to reduce exposures. Clean up efforts may also reduce off-site metal concentrations, and therefore, future exposures should be less problematic.

5. The phrase "of concern" has been changed to "of interest" for all metals. Exposure frequency values have been revised for children and adults.

The arsenic evaluation was based on screening values developed by ATSDR. The ATSDR air guideline at that time was lower than some of the concentrations found in the ambient air samples (0.0002 microgram/cubic meter). IDPH agrees that the arsenic screening values are very low concentrations, sometimes lower than background levels. The discussion of arsenic in air has been removed from the current document because any exposure that occurred at the levels and duration of time found would not be expected to result in adverse health effects.

The discussion of cadmium has been revised to reflect the current conditions at the site.

No screening values are available for lead concentrations in soil. Limited information is available to determine how much lead in different environmental media contribute to increased blood lead levels. The sentence has been modified to clarify the issue.

6. IDPH feels that we have stated that many sources of metals exposure exists in our environment and that some metals are nutrients at community meetings, health professional education activities, and within the PHA drafts during the years that IDPH has been involved at this site. We feel that we have been careful during educational activities to present these issues regarding common metal exposures and will continue to do so.

7. IDPH is aware of the safety factors included in the development of health comparison values; however, EPA's RfDs and ATSDR's minimal risk levels might not protect hypersensitive (allergic) individuals.

8. IDPH appreciates the information provided by the DePue Group regarding the site's past and current operations and have revised statements which were unintentionally confusing or misleading. The specific comments included in Appendix A have, for the most part, been considered in revising the statement, phrase, or word in question. IDPH thanks all the members of the DePue Group for their careful and thorough perusal.

9. We have included a glossary developed by ATSDR to assist readers. Thank you for this suggestion.

10. Dr. Schiffer's report has been more fully discussed within the body of the PHA.

11. We appreciate the DePue Group's investigation of the pH data, and those discussions have been removed from the PHA. IDPH must depend upon EPA to complete the QA/QC activities associated with the USEPA risk assessment guidance on data usability and often are not provided with the laboratories' documentation. That is the rationale behind including the qualifying statement in the PHA.

Appendix A. The specific comments were considered while finalizing the PHA and were helpful in developing a clearer, more concise document. Our response to your specific comments are included as an attachment.

As you know, the DePue site has been very dynamic in recent years. Therefore, we have experienced some difficultly keeping current and continuously updating any document that attempts to maintain a general summary of activities. This PHA is somewhat preliminary because a comprehensive site-wide remedial investigation has yet to be completed. Because the site was listed on the National Priorities List, ATSDR is required to release the PHA within one year of listing or proposed listing, although important sampling efforts are currently underway. IDPH expects additional site reviews and updates will be necessary as environmental assessments and remediation activities continue, data packages become available, and reports are finalized. At this time, many earlier concerns listed in earlier drafts of the PHA have been addressed DePue Group actions as well as by IDPH and other agencies.

Responses to Comments in Appendix A			
Page	Para	Line	Response
1-2			First two pages are a summary which has been revised to include the DePue Group's general suggestions, while some of the more specific details suggested here are considered in later sections of the PHA.
1	1	1	Sentences revised.
1	1	3	Sentence revised.
1	2	6	Sentence modified and moved to end of summary section.
1	3	3	Sentence modified.
1	3	6	Summary modified.
2	2	2	Sentence modified and moved.
2	2	6	Sentence revised
2	3	2	Document discussions were expanded to include two conclusions: that no urgent public health hazard was demonstrated by the health outcome data (biological screening), and that the site is considered a public health hazard because exposures have occurred in the past and the opportunity for potential exposures remain for some metals.
3	2	2	Sentence revised.
3	2	4	Sentence modified.
3	2	4	Sentence revised.
3	2	13	Sentence added.
3	3	1	Sentence modified.
3	5	9	Sentence revised.
4	1	1	Sentences modified.
4	1	6	Sentence modified.
4	1	10	Sentence modified.
4	1	16	Sentence added.
4	2	2	Comments on improved fencing added in description of each area.
4	2	3	Sentence revised.

Responses to Comments in Appendix A			
4	2	5	Sentence revised.
4	3	5	Sentence revised.
4	4	1	First sentence deleted. Statement from Gibb moved to paragraph describing main smelting operations area.
5	1	4	Sentence modified.
5	1	7	Sentence modified.
5	2	1,4,6 ,11	Sentence modified. Part of one sentence deleted. Suggested sentence added. Remainder of paragraph modified.
5	3		Paragraph regarding gypstack area modified.
6	2	2	Sentence modified.
6	2	3	Sentence modified.
6	3	4	Statement included regarding process of soil erosion and sedimentation.
6	3	4	Sentence revised.
7	2		Paragraph removed.
7			Bullets incorporated into discussions of the management of each area: smelting operations; inorganic compound manufacturing; gypstack; south ditch; Lake DePue. Operation years provided in comments incorporated into discussions.
8	2	2	Paragraph incorporated into previous discussion of fertilizer manufacturing.
10	2	2	Sentence modified into 2 sentences.
10	6	4	IEPA could not find any information on private well sampling. Sentence modified.
11	2	4	Sentences modified.
11	3	5	Sentence revised.
12	3	3	Sentence revised.

Responses to Comments in Appendix A			
12	4	item 3	Labeling of the comparison values double checked. Table on air data removed since IEPA approved discontinuing sampling because values were not high concentrations. The most conservative comparison value is used; sometimes that value has a cancer endpoint, and sometimes other health endpoints are considered.
14	2	1	Sentence revised.
14	2	2	Sentence revised.
14	2	9	Sentence revised.
14	4	5	Sentence revised.
15	1	2	Sentence modified.
15	2	1	Sentence revised.
15	2	2	Sentence modified.
16	4	1	Sentence revised.
16	5	2	Data associated with pH values deleted.
17	1	2	Sentence modified.
17	1	3	Sentence added.
17	5	1	Sentence revised.
17,18	7		Bullets removed and statements developed into text.
19	1	3	Sentence revised.
19	4	1	Section revised.
20	2	3	Paragraph deleted.
20	2	4	Sentence revised.
20	3	4	Sentence revised.
20	3	1	Sentence modified.
20	5	1	Sentence modified.
21	1	3	Paragraph modified.
21	1	5	Paragraph modified.

Responses to Comments in Appendix A			
21	4		QA/QC statement qualifies assumptions that data were validated as required by EPA.
21	6	1	Paragraph revised.
22	2	10	Sentence revised.
22	4		Paragraph modified.
23	2		Paragraph modified.
23	1	4	Sentence inserted regarding worker training.
23	2	7	Sentence modified.
23	2	9	Sentence modified.
23	4	5	Sentence modified
23	5	4	Sentence modified.
24	1	1	Sentence revised.
24	2	2	Sentence modified.
24	2	4	Sentence revised.
24	2	11	Sentence revised.
24	3	3	Sentence moved to earlier paragraph and modified.
24	4	1	Paragraph on conservation areas modified..
25	1	8	ATSDR's MRLs and EPA's RfDs may not protect hypersensitive (allergic) individuals. Statement modified.
25	3	2	Statement added regarding the extrapolation between animal experimentation and the development of protective human comparison values.
25	3	5	Sentence modified.
25	5	7	The data that were evaluated are included in the tables. Including discussions of each eliminated metal adds considerable length to the document. Statement referring to these data included.
25	6		Paragraph revised so that exposure parameters are consistent with Table 19. Table 19 revised as well. IDPH concurs that frozen soil during cold months of the year should not be included in the exposure calculations.

Responses to Comments in Appendix A			
26	3	1	Paragraph modified.
26	3	1	The ATSDR comparison values for arsenic are conservative. Arsenic is a human carcinogen, and the CREG for air, based on the concept of one-in-a-million excess cancer rate, is 0.0002 micrograms per cubic meter. Comparison values are used only to select contaminants for further evaluation. In reviewing the air data, the large majority of quarterly samples were below detection limits, so exposure was minimal. Table on air data removed from PHA. Also, because arsenic concentrations in soil are not expected to exceed comparison values and because a second source may be in the vicinity (coal-fired power plant), arsenic has been eliminated as a contaminant of interest.
26	4		Exposure calculations adjusted for a typical (non-pica) child, keeping body weight consistently 16 kilograms and adjusting exposure frequency to 3/4 of the year (39 weeks). Because these calculated potential doses remain above current MRLs for ingestion of cadmium, cadmium remains a contaminant of interest.
26-28			Paragraphs revised.
27	1		Statement revised.
27	1	1	More discussion included regarding common lead sources.
27	2	6	Statement revised.
27	4	3	Paragraph expanded to clarify.
28	1		IDPH does not have resources to speciate soil samples; the DePue Group is welcome to do so and to submit the information to EPA and IDPH.
29	2	5	Additional discussion included regarding common cadmium exposures.
30	5	1	ATSDR criteria for selecting the site conclusion category were followed. IDPH will add a second conclusion statement that no immediate concern exists, as demonstrated by the biological screening data.
30	5	12	The blood and urine screening was not a comprehensive study of the exposed population. The limited number of people tested, and the tests performed, were designed only to answer the question of whether immediate intervention was needed to stop exposure. The conclusion category is correct.
31	3	6	Sentence modified

Responses to Comments in Appendix A			
31	4	2	Sentence modified.
61		Table 16	Table 16 removed. General discussion of air sampling conducted in 1990s included in text.
62		Table 17	Table revised.
63,64		Table 18	Table revised.
65,66		Table 19	Exposure parameters revised to be consistent with text for child and adult. Pica child exposure values removed. Calculations checked.

CERTIFICATION

This DePue/New Jersey Zinc/Mobil Chemical Corporation Site public health assessment was prepared by the Illinois Department of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.

Technical Project Officer
SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with its findings.

Chief, SPS, SSAB, DHAC, ATSDR